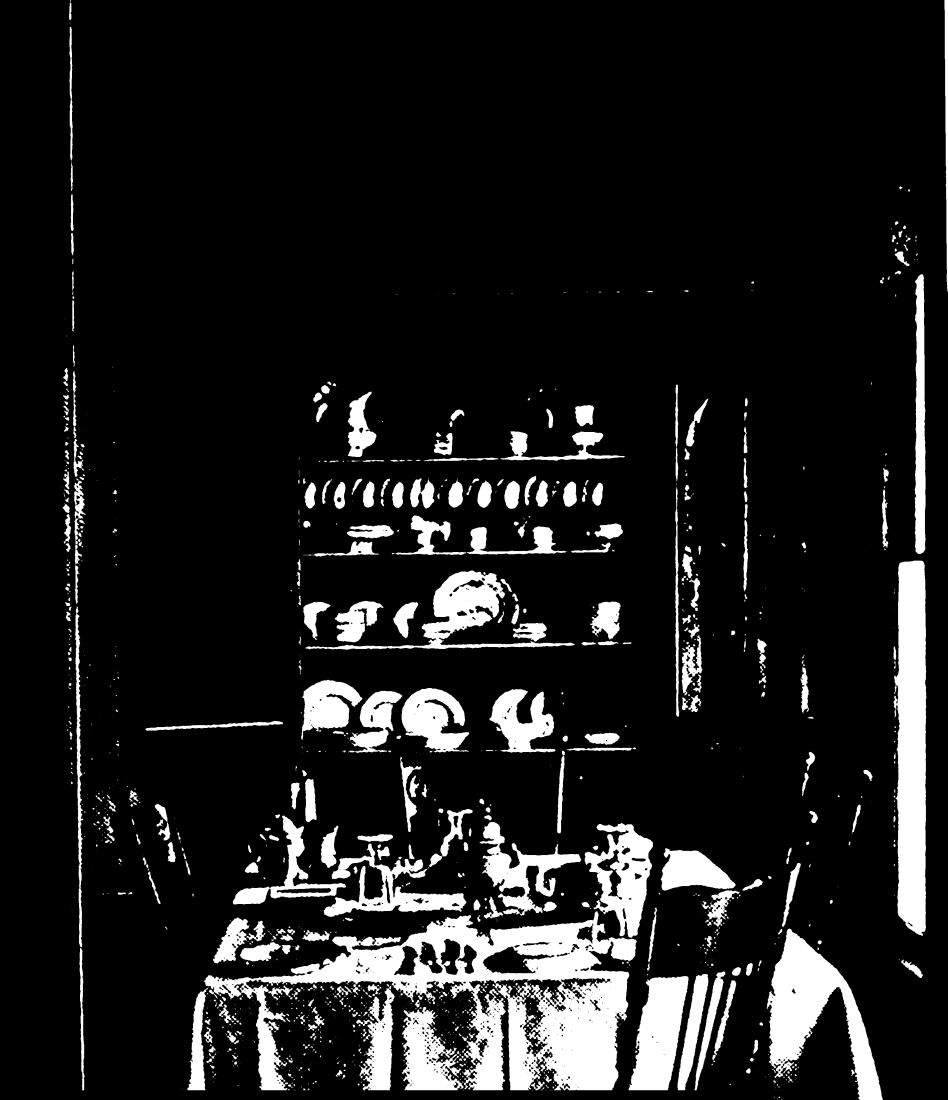

Elements of Agriculture with Industrial Lessons

Franklin Pierce Sever

ELEMENTS OF

AGRICULTURE

WITH

INDUSTRIAL LESSONS

BY

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PREFACE.

For thousands of years preceding the past century a forked stick was the only plow known to man with which he might till the soil; the hand sickle and the scythe were the only machines for reaping and mowing. The housewife had no sewing machine; the modern spindles and looms of our great factories were not invented.

Thanks, then, to the past century for steel plows, for mowing and reaping machines, and for the application of steam and electricity! Almost all the great inventions belong to the nineteenth century, — the Hercules of the Ages.

With the advent of machinery, the civilizing influences of labor became more evident, and the struggle for bread and homes, for wealth and position, became sharper, and the world realizes to-day more fully than it has ever realized that not only mental, but also physical, strength and skill are essential to the success of the future citizen.

In centuries past war was man's chief vocation and delight; to-day the world begins to look upon

labor as honorable. In the past, men have had the broad acres of new countries lying open before them, ready to reward slight efforts with abundant harvests; in the future, our workers must live in competition with machinery and by enriching an impoverished soil. In the past, while the world has been happy in nature's plenty, almost every kind of labor has been despised; in the future, intelligent labor must be relied upon to fill the emptied storehouse, and skill will be the measuring unit.

In view of these facts, effort has been made by the author to treat a few of the common duties of life in such a manner as to interest the young; to direct attention to the details of these common duties; and to assist the parent and the teacher in inculcating principles of industry and economy.

The author believes that the introduction of industrial training into our schools and homes not only brings a needed practical element into education, but also enlarges the scope and adds to the means, by and through which a complete mental, moral, and physical development is attained.

This volume is prepared with the hope that it may assist in giving such training.

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ELEMENTS OF AGRICULTURE

WITH

INDUSTRIAL LESSONS.

PART I.

CHAPTER I.

DOMESTIC ANIMALS AND FOWLS.

INTRODUCTORY.

FARMING is the business of cultivating the soil. It has ever been the chief occupation of civilized men. Indeed, it is the history of the world that, while wild men hunt and fish for food, as soon as they begin to be tamed, they begin to till the soil.

While at first they plow with forked sticks, cut their grain with awkward knives, and sow and reap with unskilled hands, in time they learn better ways and become more skillful in the use of tools.

One of the first lessons in this most necessary occupation is the care and treatment of what we call Domestic Animals and Fowls. To learn to

take proper care of these is a lesson that men have been learning for these hundreds of years, and the world has not yet learned it well.

Not only are care and skill necessary, but also goodness and mercy. The boy who is kind to his dog has a faithful friend; the man who loves his horse and tends him well has a noble servant.

The hog and the cow, the sheep and the goat, have long been sources of food and wealth. Other animals, and many fowls, contribute to the comfort of man and the wealth of the world. They all should have our protection and our care.

LESSON I.

ROVER. (A ST. BERNARD.)

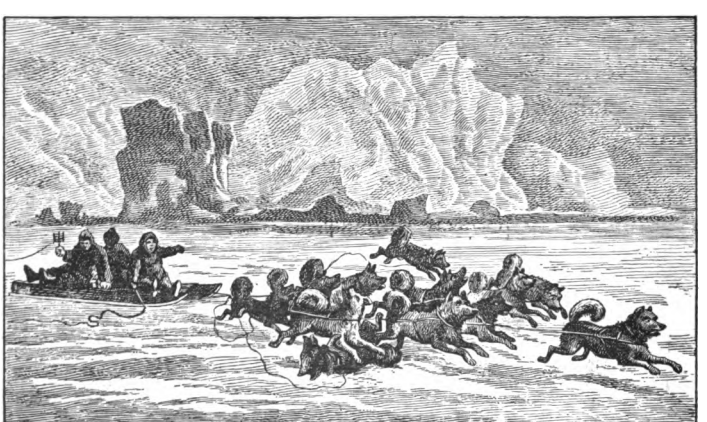
I.

Our dog at home. Name, size, age, color. His food. His house (with drawing). His disposition. Qualities that make him valuable.

2.

Anecdotes and characteristic stories about dogs. Write a story suggested by each of the following pictures: —

I.



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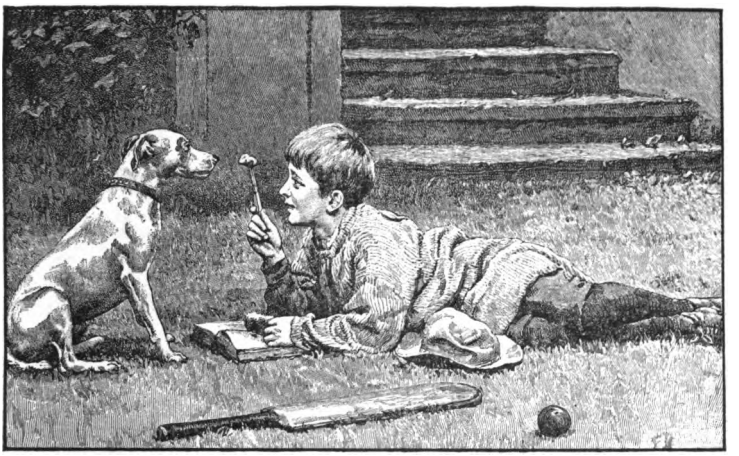


III.

3. NOTES.

1. A dog is made more useful and valuable by proper training. With dogs, as with other animals, kind, persuasive treatment is the best.
2. A dog properly trained to assist in managing or driving animals will not chase or bite them. Animals that are chased or bitten do not fatten well, and become wild and shy.
3. A dog that is cross or vicious should be disposed of at once.
4. Hydrophobia is the most dangerous disease to which dogs are subject.

5. Swimming in cold water, or lying on damp or frozen earth, will often produce stiffness of the limbs and joints. The dog's kennel (house) should be warm; the floor should be a few inches from the ground, and a fresh bed of straw occasionally provided. During warm weather the kennel may be kept closed, for the dog will then enjoy sleeping in the open air.
6. Dogs should be well fed but not overfed. Their food should be simple and wholesome. When a dog is not properly cared for, he is likely to be ill or to stray frequently from home.
7. A cat is quite as useful as a dog. A good mouser will often hunt for hours in the fields for mice. While thus hunting, it should not be disturbed in any way. Many farmers keep more than one cat. Many merchants keep a cat about the store.
8. Cats and dogs have teeth well suited to eating flesh, which forms the principal part of their food. For this reason they are called Carnivorous Animals. All animals that live mainly upon flesh belong to the *order* Carnivora.
9. The *family* to which the dog belongs is called

Canidæ. It is from the Latin word *canis*, meaning "dog." The wolf, the fox, and the jackal belong to this family.

10. The *family* to which the cat belongs is called the Felidæ. It is from the Latin word *felis*, meaning "cat." The lion, the tiger, the panther, and many other animals belong to this family.

11. The tongue of the dog is smooth, like the tongue of the horse or the sheep; but the tongue of the cat is rough, like the tongue of the cow.

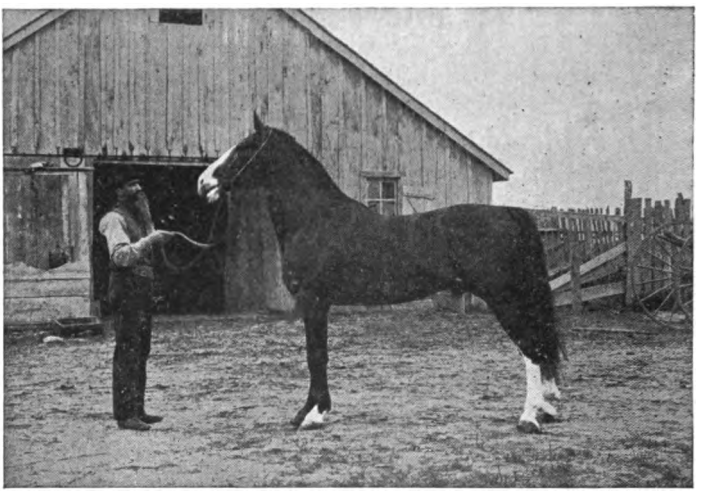
12. The dog's claws are strong, and not very sharp; but the cat's claws are slender, and almost as sharp as needles. Dogs chase their prey, but cats approach stealthily and seize their prey by a sudden spring.

13. Of all domestic animals, the dog is the most affectionate and faithful.

To THE TEACHER. — Effort has been made by the author to reduce the theory of agriculture, and lessons on the common duties of life, to a *practical working basis*. Each lesson is divided into sections which may serve as subjects for recitations.

Culture, nature study, practical knowledge, — these are the leading objects sought. Conditions, and the teacher's judgment, will determine the amount of supplementary work that may be done along lines suggested by the text.

LESSON II.



THE HORSE.

I.

There is no nobler animal than the horse. He is strong and will draw a heavy load, or carry a burden on his back. He is active, and can travel at either a slow or a rapid gait. He is graceful in form and movement; he is intelligent and easily trained; he is kind in disposition; of long life and great endurance, and for ages past has served man both in time of peace and war.

No animal deserves kinder treatment, and yet many horses are much abused.

A farmer could not well raise crops or do other work on the farm without horses. They are also much used in the cities.

Horses are a source of pleasure, too, as well as profit. Who does not enjoy driving a spirited team? How delightful, also, to ride through the fields on the back of a good traveler!

Earth makes the best floor for the stable. A plank floor is too hard. A horse will tire standing on a plank floor; the feet will grow tender, and the limbs become swollen. If possible, the horse should have a fresh bed of clean straw every night. Most horses like to be curried or rubbed with a cloth or a soft brush.

The animal's body should be kept as clean and free from dirt as possible. A clean stall and wholesome food go far toward keeping a horse in good health.

2.

A horse should be given plenty of hay and some grain each day. An occasional change in food may improve his health and appetite. In changing from one kind of grain to another, care will be necessary that too much grain is not given at one time.

The hay that a horse eats should be as free from dust as possible, because musty or dusty hay

is injurious and will produce a disease called "heaves." Wild or prairie hay is desirable food, because it is usually free from dust. Timothy hay is excellent and is very generally used. When at hard labor a horse needs more grain than when not working; but he requires plenty of hay, whether at work or at rest.

Impure water is even more injurious than impure food. Food and water should be given at regular intervals. The horse that is not fed or watered at regular intervals is likely to overeat or overdrink. Overeating may result in what is called a grain founder. Overdrinking may result in a water founder. A horse may also be foundered if he is fed or watered when he is too warm. When foundered he will show lameness and a stiffness in the limbs.

3.

1. About how many ears of corn should be given to a horse at one feed when he is being worked or used?
2. How many if he is not being worked?
3. Should you give as many large ears at one time as you would small ones?
4. Should you feed a small horse as many ears as you would a large one?

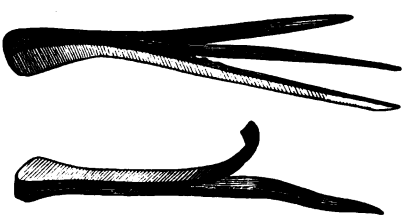
5. Why not feed a horse corn that has the husks on?
6. What care should be observed in putting hay into a manger?
7. About what quantity of oats should be given at one time?
8. What is "chopped" food or chop?
9. How much chop should be given at one time?
10. Why give chopped food when the horse's teeth get sore or short?
11. Why should the bridle not be left on when the horse is fed?
12. Do all horses drink well with bridle bits in their mouths?
13. Why is it sometimes dangerous to water a healthy horse at a public watering trough?
14. Why should a leaden pipe never be used in conveying water for man or beast to drink?
15. How often should a horse have water and food?
16. Draw the plan of your barn at home.
17. Draw another convenient plan.
18. Show the convenient features of each plan.
19. What should be the length, width, and height of a stall for one horse?
20. Why should the stall be so much higher than the horse?

LESSON III.

THE HORSE (*Continued*).

I.

Sometimes a horse is made lame in shoeing. The shoe may be too narrow at the heel and cause the hoof to bind; or it may be too small for the hoof, producing fever and lameness; or in putting on a shoe, a nail may split and one part may go too far up into the hoof.



SPLIT HORSESHOE NAILS.

A shoe that is too heavy tires the horse and may injure the hoof. Shoes should not remain too long on the hoof after any shoeing, because the hoof is constantly growing and in a few weeks will outgrow the shoe.

Care, too, should be observed in adjusting the harness. If the collar is too tight, the horse cannot breathe well; he will experience a sense of choking and will soon fag; he will have less endurance than he would have if he could breathe freely. A collar

that is too tight will pinch the neck and injure the shoulder. Injury to the shoulder may result also from the use of a collar that is too loose.

A collar that fits in the spring, when the horse is in good flesh, may be so large as to require the use of a collar pad after the animal has been worked for a few weeks and has lost flesh. Sweeney is an injury to the shoulder most commonly attributed to the use of a collar that is too large; this injury, however, may also be produced by a sprain, a bruise, hard usage, etc.

2.

Every horse has a certain swing of the head as he travels. If reined too high, he loses the free use and swing of the head, and cannot see so well where to step; traveling then becomes more tiresome.

Laborers do not wear tight clothing on any part of the body, but dress so that they will have the use of every limb, and so that no muscle will be bound or placed in a strained position. A horse should be so harnessed that every muscle may be brought into free use and so that no part of the harness will obstruct breathing, or circulation, or movement of limb.

If a "blind" bridle is used, the "blinds" should not be so drawn together as to shut out the light

and the fresh air from the eyes. Blinds that fit too closely over the eyes will heat them in warm weather and produce disease and even blindness.

An easy bit should be used in the bridle. For horses with tender mouths, a bit covered with rubber is recommended by many, especially for winter use. If a raw iron bit is used in cold weather, it should always be warmed before it is put into the horse's mouth. A cold bit is very painful to the mouth and will produce ulcers.

In hitching a team of horses to a vehicle, the following order should be observed: —

First, properly snap or fasten all the line checks to the bridle bits. The lines once arranged, the neck yoke should be put on, and the tongue of the vehicle raised and fastened. Lastly, the tugs or traces are to be hooked or fastened. This order is reversed in unhitching. In hitching a team, it is best to examine all fastenings, to make sure that everything is in readiness, before the team is started.

3.

1. In unhitching, why should the tugs be loosened before the checks of the lines are unsnapped?
2. Why unhook the tugs before letting down the tongue?

3. Why should all parts of the harness be firm and well fastened?
4. Why should the lines never be tied to a wheel of the vehicle to which the team is hitched?
5. Why should very heavy vehicles be provided with a lock or break? (Give three reasons.)
6. Why not keep the harness in the stall near the horse?
7. Should harness ever be oiled?
8. Give some precautions to be observed in the use of a team.

LESSON IV.

AMONG THE POULTRY.

I.

Joe Bell and his sister Kate are industrious children. They take pleasure in raising poultry. Mr. and Mrs. Bell encourage them in this work, and provide them with books and papers which teach them how to care for fowls of every kind.

It is said that the poultry and eggs of our country bring more money than do all the horses, mules, and sheep together.

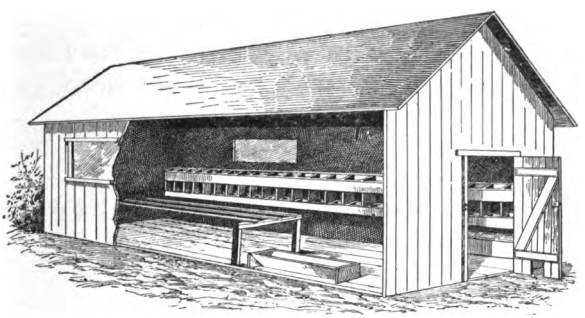
The proceeds from the sale of poultry, which Joe and Kate raise, add much to the income of Mr. and Mrs. Bell, and the children are glad to know that they are helpful to their parents.

They began with a few chickens. Now they have as many as they can care for. At first they knew little about the care of poultry, but they have learned much, and find that there is yet much for them to learn.

They have learned that there are many varieties of chickens: that some varieties are large, and others are small; that some have flesh that is fine in texture and of sweet and delicate flavor; that the flesh of others is coarse, and may not have an agree-

able flavor; that some varieties are wild and refractory; that others are tamer, and more easily managed; and that some varieties produce more eggs than others.

Kate says that she thinks the best variety is the one that combines the good qualities of all.



THE HENHOUSE.

2.

Kate and Joe agree that the henhouse should be well kept. They frequently dash the walls with hot water, and sometimes with coal oil and dilute carbolic acid; and occasionally Mr. Bell fumigates the building for them.

To do this he puts a handful of sulphur in an iron vessel kept for that purpose, and placing this in the henhouse, after all the fowls have been driven out and the windows have been closed, he sets fire to the sulphur, and then very quickly

goes out and closes the door behind him. The smoke and fumes from the burning sulphur fill all parts of the building and kill any insects that may be in it.

After a few hours he opens the doors and windows and allows the fresh air to pass through before the fowls enter. He is very careful not to breathe any of the smoke or fumes, and to leave the henhouse the moment he sets fire to the sulphur. Joe thinks that he will be old enough in a few years to do this work himself.

Kate frequently sprinkles well-slaked lime about the henhouse and yard; this is good for the health of the fowls.

Mr. Bell has given Joe some tools, and with these he has made screens for the windows, so that he can safely ventilate the henhouse at night in warm weather. He has also made coops of such boxes, boards, and slats as he could get.

With a little help and advice from his father, Joe has built a long row of nests with tight board covers.

Mrs. Bell assists Kate in taking care of the hens while they are sitting, and of the little chicks while they are young.

Kate likes to feed, water, and care for the fowls. She gives them soft food in the morning, and grain

or hard food in the evening. She has read that fowls thrive better when fed in this way, especially in the winter time. Chickens need plenty of pure water to drink; milk is wholesome for them.

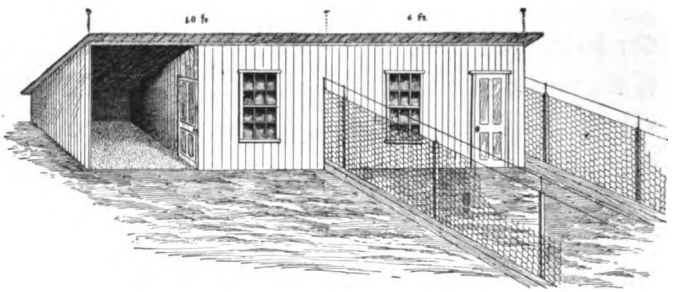
Kate never gives oats to any of the fowls. She has been told that the sharp points on the grain hinder digestion. At times she feeds them with some fat meat, or with some liver when she can get this for them. She has learned that fowls like sunflower seed, the seed of sorghum, Kaffir corn, millet, Hungarian, wheat, corn, and other grain. Most fowls are fond of fruit, but fruit does not fatten them rapidly.

3.

NOTE. — Comparison of the value of the poultry, eggs, and feathers with the value of the horses, mules, sheep, and wool shipped from one state of the Union in one year, as shown by report of the Commissioner of Labor: —

Poultry,	70,081,267 pounds,	value,	$4,905,689
Eggs,	33,935,325 dozen,	"	3,393,533
Feathers,	439,172 pounds,	"	197,637
	Total	"	$8,496,859
Horses and Mules,	89,849 head,	value,	$3,961,442
Sheep,	462,406 "	"	1,757,154
Wool,	3,179,297 pounds,	"	735,859
	Total	"	$6,454,455

LESSON V.



A Convenient House and Yard.

AMONG THE POULTRY (*Continued*).

I.

Mr. Bell has a small plot of ground with a high, close fence around it; the henhouse opens into this plot from one side, and from the other side it opens into a larger plot of ground. When the weather is fair, Joe and Kate allow the fowls to "range" in the large plot. Here they chase grasshoppers, or scratch for crickets and worms.

The little chicks like to get out in the large lot, and it is amusing to watch them as they toddle after the mother hen, or scamper to her when she finds a sweet morsel and calls to them.

When a hawk comes near, the mother hen, or perhaps the rooster, gives a peculiar cry, — the

danger alarm, — and then all the fowls run to a clump of shrubs and vines for protection. The chicks spread their wings and run as fast as their little legs can carry them, for they, too, know the danger cry. When a storm threatens, the fowls are hurried into the small lot, where they find shelter, and where the chicks may be kept warm and dry.

During cold weather Joe keeps some straw or hay in the small lot, and into this he throws the food. The hens scratch in the straw for the food, and in this way they get exercise. Joe thinks that the fowls have better health, and that the hens lay more eggs when they have plenty of exercise.

In the small lot he has also an old barrel, with warped staves and cracks between them. In the fall he fills this with dry sand and ashes. From this barrel the fowls get gravel to eat and ashes and sand in which to dust themselves.

Two or three times a year, and before Mr. Bell fumigates the henhouse, Joe takes all the old straw from the nests and from the lot, and Kate scatters slaked lime and sprinkles coal oil about the premises. Insects frequently kill poultry, and great care must be taken to keep the buildings and fowls free from them. Fowls are also subject to various diseases which care may prevent or cure.

The rat is a dangerous enemy to poultry. There are various methods of trapping it; and when one method fails, another may succeed. Minks and weasels, too, sometimes create havoc in a poultry yard, killing many fowls in a single night. There are still other enemies to contend against, and it is only by care and close attention that all members of a brood are raised.

Joe and Kate are learning more and more each year about poultry and its care, and soon they hope to raise successfully the best varieties known.

2.

1. How many toes has a chicken?
2. Which domestic fowls are scratchers and which are swimmers?
3. What is the difference between the toes and feet of the two classes?
4. What is the difference between the bills or beaks of the two classes?
5. Are fowls animals?
6. Are all animals fowls?
7. Name two ways in which feathers are useful to fowls.
8. Name three uses people make of feathers.
9. What marked difference is there between the bones of fowls and the bones of other animals?

10. Describe the end of the tongue of a fowl or bird.
11. Compare the size and color of the eggs of a few fowls.
12. Why handle hens with special care, and work gently with them, when they are sitting on eggs, or while they are raising a brood?
13. In setting a hen, why sprinkle a little finely powdered tobacco in the nest?
14. Why repeat this occasionally while the hen is sitting?
15. When a fowl is in good health, what color are the comb and gills?
16. Give several reasons why it is beneficial for fowls to range, both in winter and in summer, whenever the weather will permit.
17. What evidence may be given that tends to prove that fowls have language, or means of communicating with one another?
18. What benefit do chickens derive from taking dust baths?
19. Do any fowls or birds take water baths?
20. Do any take both dust and water baths?

3.

Following are some varieties of fowls: —

CHICKENS.

Bantam. — Variously colored; very small; eggs small.

Brahma. — (1) Light. (2) Dark. Very large; legs feathered; good layers; eggs large; good flesh.

Cochin. — (1) Black. (2) White. (3) Buff. (4) Partridge. All large; legs feathered; good layers; eggs large; very hardy; good flesh.

Plymouth Rock. — (1) Barred. (2) White. Large; good layers; eggs large.

TURKEYS.

Mammoth Bronze. — Very large; bright bronze color; good flesh.

White. — Large; good flesh.

Black. — Small; hardy; good flesh.

GEESE.

Gray Toulouse. — Very large; lay about forty eggs in a season; flesh coarse and flabby.

White Embden. — Snow white; very large; blue eyes; flesh-colored bill; feet yellow or orange; lay about twenty eggs in a season.

Gray African. — Very large; very rapid growers; lay about forty eggs in a season; excellent flesh; very desirable variety.

Gray Wild. — Medium to large; hardy; good layers; excellent flesh; desirable variety.

DUCKS.

White Pekin. — Very large; rapid growers; lay from one hundred to one hundred and thirty eggs in a season; yellow bill; blue eyes; hardy; flesh excellent; very desirable variety.

White Aylesbury.— Very large; mature early; blue eyes; flesh-colored bill; very hardy; desirable variety.

Colored Rouen. — Medium to large; head of good form, with rich, green plumage; resemble Mallard duck; slow growth; hardy.

Black Cayuga.— Medium to large; dark, hazel eyes; grow rapidly; lay from eighty to ninety eggs in a season; hardy.

CHAPTER II.

IN THE HOUSE, IN THE GARDEN, AND IN THE STORE.

INTRODUCTORY.

WHILE men are in a savage state they do not build homes. The wide world is their home, and they roam from place to place warring with each other, and are almost as wild as the animals they hunt for food. As they become civilized they build a place in which to live, and which our Anglo-Saxon forefathers have named *home.*

Twelve hundred years ago these very Anglo-Saxons, from whom we are descended, lived in rude huts built of sticks bound together at the top. The floors were of earth, sometimes covered with grass and leaves. Their *fine* homes had the *bark pulled from the poles.* When we think of such homes, and compare them with the good homes that we live in at the present time, we find that our race has learned much in these hundreds of years.

To learn to care for our homes properly will mark one of the sweetest pages in the history of our lives. All that is brightest and best belongs to

home. The care of the rooms in which we read and think; of the table around which we gather; of the parlor where song and story add to the charm of life — this care is a labor of love that small hands can do, and it belongs to the lessons of life.

Then there is the yard where the roses and the honeysuckles grow; the garden with its good things for every season; and the orchard where the apple trees bloom and the brown thrush and oriole sing their sweetest songs. The farmer's boys and girls may be happy and useful here. There is a joy in all of these things.

To learn to do work well is no little thing. People in the past have helped us by writing about better ways of doing things. Let us help the whole world by learning to do these things better.

LESSON VI.

HELPING MOTHER.

I.

"Mother, dear, you have so much to do! Will you let me help you in some way?"

"Thank you, my child, I should be very glad if you would wipe the dishes for me. Do you think you can?"

"I am sure I can if you will show me a little about it."

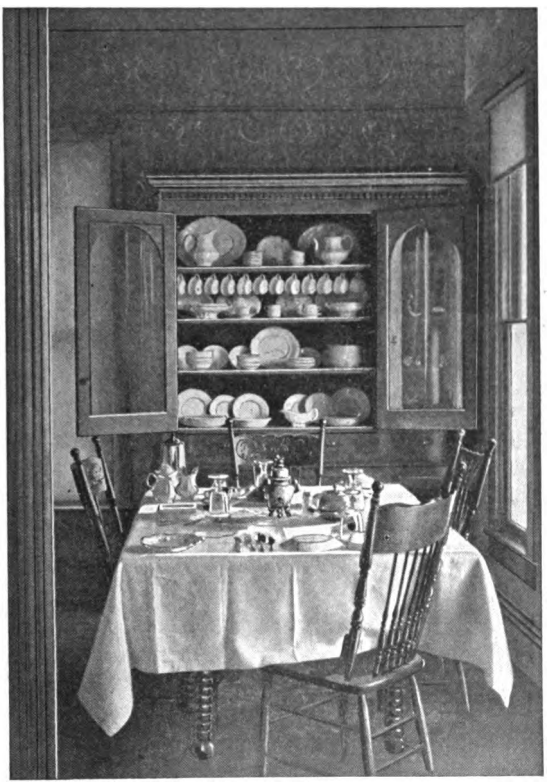
"First, then, you may wipe these glasses. See, I dip them sidewise into these hot suds. Take this clean dry cloth and wipe them before they get cold. Give them a good polish and put them on the shelf upside down so that they may not get dusty inside.

"Now I will wash the spoons and lay them in the draining-pan. I will pour hot water over them and you must pick them out as best you can. The hot water gives them a fine polish. But you must be careful not to put the dishes into such hot water. It would 'check' them and perhaps break them."

"Why do you handle the cups and saucers so carefully, mother?"

"So that I shall not break them. It is very easy to chip the edges of dishes. Each piece should be

washed separately. Never pile up the dishes in the dish-pan, or try to carry too many at a time."



THE DINING ROOM.

"Does it injure knives, too, if they are placed in hot water? You are washing those in water that is not very warm."

"These are steel knives, and the heat is not good for the metal or the handles. You see I am not putting the handles into the water at all. I wipe them with a damp cloth. Now I must rub the blades with a little polishing brick dust and rinse them once more. There they are, ready for you to wipe.

"Now wash out your drying cloth in clean cold water and hang it near the stove. I will put the dishes away while you wipe the top of the table. You have helped me very much this morning. Should you like to try again to-morrow."

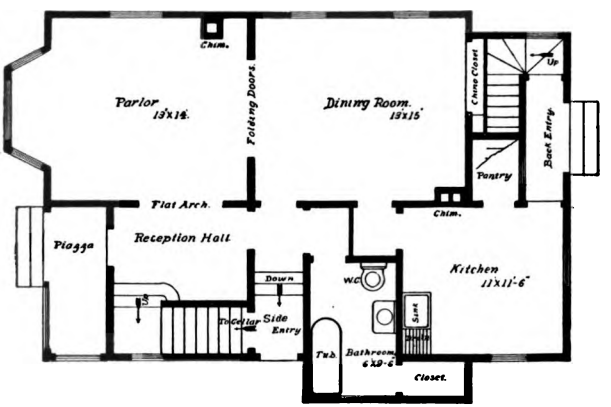
"Yes, mother, I want to help you. I want to learn to do various kinds of work."

"Now I have polished the stove, and when I have swept the floor the kitchen will be in order."

2.

1. How often may knives be polished?
2. What materials are required in polishing them?
3. Describe the process.
4. How often should the kitchen stove be polished?
5. What are the bad results of spilling water on the kitchen stove when the stove is hot?
6. Why not pile up the dishes in the dish-pan or try to carry too many at a time?

7. Why first wash the dishes that have the least grease on them?
8. Why not place dishes on a very hot stove?
9. Why not place dishes near the edge of the table as you wash or dry them?
10. Draw a plan of your kitchen and dining room.



NOTE. — A working model is here given. In drawing original plans, give special attention to light and to convenience in arrangement.

3.

Father says: —

"Unless you are saving and careful and neat,
You must not expect much good fortune to meet."

Mother says: —

"Cleanliness is next to Godliness."

LESSON VII.

HELPING MOTHER (*Continued*).

I.

"I learned much yesterday about taking care of dishes. Will you teach me something more to-day about housework?"

"Yes, I am ready to put the house in order and need your help. We shall begin by opening this room so that more sunlight may come in, and the draft may help to take away the dust. Plenty of sunlight and fresh air are essential to health and happiness.

"Dust clings to some kinds of furniture and is not easily removed. We shall take such pieces into the next room, or cover them before beginning to sweep. As soon as I have finished sweeping, I will show you how to dust.

"We shall use these clean, soft cloths in dusting. They will not scratch or injure the furniture. Rub the woodwork lightly, first the upper window sash and casing, the doors and door casings, the tallest pieces first, beginning at the top and dusting toward the bottom.

"When the cloth gets dusty, take it to the open door and shake the dust from it. A cloth slightly

the butter cared for, Aunt Ruth treats the churn just as she does the other vessels; that is, she thoroughly cleans it by washing it with warm water, then rinsing it with hot water and placing it where it can get the air and sun.

"The churn should always be treated with hot water, and rinsed with cold water just before use. Uncle Ben does the churning, but Aunt Ruth prefers to take care of the churn and the milk vessels herself.

"The butter they make is always in demand at good prices. It pays them to take pains. In fact, they work upon the principle that 'whatever is worth doing at all is worth doing well.'"

3.

"Uncle Ben has no machine or separator with which he can separate the cream from the milk, as some of his neighbors have, and for this reason he is obliged to strain the milk into cans and allow the cream to rise. He is planning to get a separator some day, and then he will get more cream from the milk than he gets now, and Aunt Ruth will not have so many cans to wash.

"Years ago he kept the milk in crocks, and in wide, shallow pans. He concluded, however, that these shallow vessels took up too much room, and

exposed too much milk surface to possible impurities. Now, as soon as he milks he at once strains the milk into narrow, deep cans and sets them in a box partly filled with cold water. The box has a hole near the bottom through which he can let the water run out into a trough that carries it away. The box did not cost him very much, as he made it himself. He finds it very useful, for he has no spring water flowing through his milk house. The one box contains all the milk cans, and cools the milk thoroughly.

"Uncle Ben says there are a great many 'secrets' in the care of milk, and in butter-making. By 'secrets' I think he means facts that are not generally known, because he does not try to keep these facts to himself.

"I am especially interested when he is telling about the tiny, living germs that are nearly always to be found in milk. Some of these germs, or bacteria as he calls them, are needed for the ripening of cream, the flavor of the butter, etc.; though too many may be harmful. He says that cream must sour before it is ready to be churned, and that it is the presence of bacteria that causes it to sour; but if it stands too long, too many bacterial germs will develop, and the butter will be bitter or 'rancid.'

"In addition to the beneficial bacteria that are in milk, disease germs, or bacteria that are dangerous to health, are also frequently found. The usual sources of these disease bacteria are, — diseased cows; uncleanliness in milking and in the stables in which the cows are kept; and neglect to care properly for the milk.

"He says that no unhealthy cow's milk should be saved; that the stable should be kept clean, and the cows well bedded; and that any bits of dirt and loose hairs that may be clinging to them should be brushed or rubbed off before milking; that cleanliness in the stables and in milking is not only a health precaution, but usually removes the frequent cause of bad tasting milk, cream, and butter.

"Since Uncle Ben explained to me that bacteria multiply rapidly in fresh, warm milk; that cold is unfavorable to their development; and that it is mainly these germs that cause milk, as well as cream, to sour; I understand why he always strains the milk and sets it to cool as quickly as he can after milking. And since he further explained to me that milk readily absorbs odors, I understand why he never keeps vegetables or fresh meats in the milk house or near the milk.

"He prefers to keep milk at a temperature of from forty-five to fifty degrees Fahrenheit; this

retards the increase of bacteria, and in this way helps to keep the milk sweet; and he thinks the cream rises better if the milk is cool. The milk should not be frozen, however, because cream cannot rise through frozen milk.

"As Uncle Ben skims the cream from the milk he puts it into a jar and keeps it cool and sweet, just as he does the milk, until he has saved enough for churning. Then he 'ripens' or sours it; that is, he warms it to a temperature of sixty to seventy degrees Fahrenheit, and keeps it at this temperature for some hours, until it is pleasantly sour to the taste. He then cools the cream again before he churns it.

"Uncle Ben says that the butter we eat is contained in warm milk in the form of oil, and in cream in the form of little specks or globules, commonly called butter fat; and that churning the cream causes these fat globules to strike against each other, and in striking each other they adhere and form grains of butter. The quality of butter produced depends to a considerable extent, he says, upon the way in which the cream is churned. For this reason he is particular as to the kind of churn he uses.

"He prefers the common swing churn, or the plain revolving barrel churn without inside fixtures, because such churns may be kept sweet and clean with little difficulty, and he thinks they give a better

concussion to the globules of butter fat, and hence produce a greater quantity of butter from a given quantity of cream than can be secured by using a churn with a dasher, revolving paddles, or other inside fixtures. Any fixtures that strike the grains of butter tend to injure its texture, and in that way may injure its quality.

"Churning should not be continued until the butter solidifies, that is, until it forms into a body, or even into large lumps, but should cease when the butter shows in grains or lumps about the size of peas. If churning is continued too long after the butter forms, or if the butter is worked too much in removing the buttermilk or in distributing the salt, the grain or texture will be injured, and it will have a greasy appearance.

"When Uncle Ben takes the butter from the churn he places it on the working-board and removes the buttermilk from it. To do this, he first dashes some cold water upon it. If dashing water upon it once does not remove all the buttermilk, he works the butter a little and then washes it again. Water must not be used too freely, however, because much washing takes the flavor from it.

"Uncle Ben thinks that coarse, or common salt, should not be used in salting butter. He uses none but table or sack salt for this purpose, because

fine salt distributes with less working, and dissolves and salts more evenly than coarse salt does.

"The butter properly salted, he forms it into neat rolls and puts them on plates in a cool place ready for use, or ready for the market."

LESSON XIII.

THE FARMER'S FRIENDS — DO YOU KNOW US?

I.

(*a*) "I am small but I am master of many birds that are larger than I. I build a nest of sticks, and line it with wool or lint, and prefer to build in the hollow of a rail or a post, or under a porch near a house. I am gray-brown in color. I destroy many insects in the course of a year. The last letter in my name is the first letter in the word 'name.' Guess my name."

(*b*) "*H*ow I am feared by the feathered tribe! *A* beak with a sharp hook at the end, a pair of sharp claws and strong wings, makes me the easy master of most birds. *W*ith a shrill cry I terrify them, or with my swift flight I overtake them. *K*indness has never been charged against me; but I destroy mice, and sometimes kill a snake, and hence claim credit for doing some good. Farmers seem to have a grudge against me. I have many brothers, sisters, and cousins, and we all bear marked resemblances to one an-

other in appearance and habits. Can you spell my name from leading letters in what I have told you?"

(*c*) "I am a large bird and live in the streets of southern cities. I eat decaying fruit and other impurities that are thrown into the streets. I am kindly treated because I am a scavenger. Do you know me? Do you know my relatives?"

(*d*) "My feet are webbed, but that makes me able to swim; my bill is flat, but that makes me able to get the food I like best; when I walk, I jerk my head in a queer way, but that helps me to keep my balance; I am prized most for what I carry on my back. My song is quack, quack, quack."

(*e*) "*J*ust as blue is the coat I wear,
*A*s any soldier's in the land;
*Y*ou hear me shouting everywhere,
In tones of loud and sharp command.

"My beak is like a bayonet,
And fear I never felt or knew;
And often when a foe I've met,
I've shown him how my soldiers do.

"If 'Jimmy' Crow comes near my nest,
I hit him with my beak a whack;
And when he flies I follow up,
And peck and scratch him on the back.

"You'll know my name if you are wise,
It's fairly plain before your eyes."

(*f*) "Poor me! Poor me!
I am not a bird, I am not a bee;
My legs are so short I can scarcely run;
My eyes are so small I can scarcely see;
Poor me! Poor me!"

"My teeth are so small and frail that I can eat nothing but worms and bugs and an occasional tender root or bulb. It is reported that I was once buried alive because I was found rooting in a lady's garden in my search for worms. Poor me!

"I work for days and even weeks to find the worms in a patch of grass land, a garden, or a field; and when some of the grass dies because the worms have eaten the roots; or when some of the plants wither and die because their roots were cut by the worms I found and killed, the farmer often hunts me with his dog, and then I have to go deep down into the ground in order to escape.

"Poor me! Poor me!"

2. NOTES.

1. Many birds feed almost entirely upon insects. Birds that are ground-feeders eat such insects as they find in the grass and among the leaves, or such as they find by scratching in the earth. A flycatcher usually catches its prey while on the wing; other birds take worms and bugs from the leaves of growing plants; others locate and destroy worms that work beneath the bark.

   Chickens, turkeys, and ducks are examples of ground-feeders. Many wild birds feed either entirely or in part upon the ground. The kingbird is a flycatcher; the robin takes worms from the leaves of plants; the woodpecker takes worms from beneath the bark.

2. Birds that by some people are thought to be harmful are often wrongfully accused.

   For example — a bee raiser once suspected that the kingbirds, often called bee-martins, were killing his bees. He shot a number of these birds and had the contents of their stomachs examined, but not a trace of honeybees could be found.

3. For many years the government has employed and paid men to determine the kind of food

that different birds live upon. These men have examined the stomachs of many hundreds of birds, and in other ways have sought information concerning their food and habits. Following are a few examples of experiments they have made and of facts they have learned.

(*a*) At one time they examined the contents of the stomachs of 281 kingbirds collected from various parts of the country. They found the remains of bees in only 14 stomachs; in these 14 stomachs they found only 50 bees; 40 of these were drones and 4 were known to be workers; the remaining 6 were so badly broken that the sex could not be determined. The remains of 19 robber flies were found in the 281 stomachs. Robber flies are insects that prey upon other insects, and especially upon bees. These experiments prove that about 90 per cent of the food of the kingbird consists in flies, wasps, beetles, and other injurious insects, and that honeybees constitute only a small part of their food. In addition to the large number of harmful insects this bird destroys, it is otherwise useful. It usually builds its nest in an

orchard, or in a grove near a house. If a hawk or a crow approaches its nest or disturbs the fowls of the near-by barnyard, this bold little bird at once attacks it and drives it away.

(*b*) These men also determined that about 93 per cent of the food of the phœbe consists of worms and spiders.

(*c*) An examination of the stomachs of 46 black-billed cuckoos showed remains of 906 caterpillars, 44 beetles, 100 sawflies, and 15 spiders.

(*d*) The 109 stomachs of the yellow-billed cuckoos examined showed remains of 1,865 caterpillars, 93 beetles, 242 grasshoppers, 37 sawflies, 69 bugs, and 86 spiders.

3. QUESTIONS.

1. Name six kinds of birds that, during certain seasons of the year, assemble in flocks, bevies, or droves.
2. Name two birds that catch mice.
3. Name three that catch flies.
4. Name four that are good songsters.
5. State some differences in the way birds fly, (*a*) in the motion of the wings; (*b*) in the

motion of the body; (*c*) in the line of direction, whether straight or curved; (*d*) in their endurance in flight; (*e*) name birds that cannot fly.

6. What birds furnish the best feathers for pillows and beds?
7. Should birds be killed and their plumage used for trimming hats?
8. Do not most birds destroy insects?
9. Which is wiser and better, to kill the birds, or let them live to destroy insects and to make the world happier and better by their presence and their songs?
10. Have you read the poem entitled "The Birds of Killingworth," written by Henry W. Longfellow?

LESSON XIV.

IN THE ORCHARD.

I.

The earth gives man food, shelter, and clothing. The trees of the forests, the iron and tin of the mines, the stones of the hillsides, he shapes into buildings; while various vegetables and animals give him the materials for his clothing and his food.

Man, in his savage state, makes use of such fruit as he finds growing in the forests, and he uses these largely in the form in which he finds them, much as birds and animals do; but as he becomes wiser he cultivates these fruits, adds to the varieties, and learns, in time, how to store them for future use.

Knowledge in this direction is not so easily or so rapidly gained as one might think.

For example: man has always been a consumer of fruit, but the principle of canning and thus storing it for future use is a modern discovery. There was a time, too, when he depended upon the forests in his neighborhood for his supply of fruit, but as each neighborhood became more thickly populated, nature's supply was found to be too limited for the demand, and these conditions led to fruit culture or fruit growing.

Soil has something to do with the best growth of fruit, but *climate* and *culture* are even more important.

Some fruits, such as bananas, oranges, lemons, etc., thrive only in warm or tropical climates. Others, such as apples, peaches, grapes, plums, etc., grow in a temperate climate, and over a wider range of country.

2.

The practical farmer and fruit grower is at present most interested in the culture of the trees or plants he desires to grow, and in the care of the fruit after it is matured. He usually selects a piece of ground for his orchard that is sufficiently rolling to drain itself. He takes special pains in setting the trees or plants, because he realizes that their life and growth depend largely upon the manner of their planting and the attention they receive after they are set.

He digs a hole somewhat wider than the actual spread of the roots, mellows the soil in the bottom of the hole, and carefully covers the roots with rich, loose earth. He sets the plants in straight rows, in such a way that they may be cultivated in more than one direction. When setting the trees he usually leans them in the direction from which the prevailing winds of his locality

blow, and makes the earth firm around them after they are set.

He plows his orchard for the first few years after it is set, throwing the soil towards the trees one year, and from them the next year, thus securing nearly level cultivation. He keeps the top soil loose and mellow near the young trees by the use of a hoe.

He does not allow weeds to grow in the orchard. They take moisture from the ground that should go to the trees; they attract insects, breed disease, and are unprofitable. Clover and cowpeas are good cover crops for the soil, and he occasionally turns a crop of one of these products under while it is green, especially if his orchard does not grow well.

He keeps his orchard well trimmed and free from dead limbs. In some sections of the country wood worms, called borers, work beneath the bark of the trees, usually near the tree roots, and do much damage to orchards. Trees should be examined two or three times a year and the borers removed.

Birds destroy many worms and insects that infest orchards. Successful farmers and fruit growers do not depend entirely, however, upon the birds that may fortunately inhabit their orchards, to rid the

trees of insects and worms. They first seek to keep their trees healthful and vigorous by proper culture, and thus help them to throw off disease, and resist the attacks of insects. If this is not enough they must try spraying and other protective measures.

Insects that eat or chew the leaves of plants, such as the canker worm, bud-moth, codling-moth, tent caterpillar, etc., may be destroyed by the use of a poisonous spray. Such a spray may be made by putting Paris green (or London purple) in lime-water in the proportions of one pound of Paris green (or London purple) and one or two pounds of slaked lime to two hundred gallons of water. The lime is used to prevent injury to the foliage from the Paris green.

Insects that do not eat the leaves, but get their food by sucking the sap from the leaves or stems, — as plant lice and scale insects, — may be destroyed by applications that injure the bodies of such pests. For this purpose a kerosene emulsion will be of service.

To make such a spray, dissolve one-half pound of soap in one gallon of water (soft) and add two gallons of kerosene; to this, add from five to twenty gallons of water.

Cabbage worms, currant worms, and other in-

sects with soft bodies may also be destroyed by this spray.

Fungous growth or diseases, such as leaf blight of plum and pear, apple scab, black rot, black-knot, mildew of the grape, etc., may often be destroyed by a spray called the Bordeaux mixture.

To make such a spray, put six pounds of copper sulphate into a cloth bag, and suspend it in an earthen or wooden vessel containing six gallons of water, until the copper sulphate dissolves; then dissolve four pounds of quicklime in an equal amount of water; finally add enough water to make forty or fifty gallons in all of the mixture.

Four ounces of Paris green (or London purple) added to forty or fifty gallons of the Bordeaux mixture makes a good spray, and may be used for both insects and fungi.

The time for spraying will depend upon the kind of fruit to be protected, and the nature of the pest for which the spray is used.

3.

Much of the profit in fruit growing depends upon the manner of picking and packing the fruit.

To illustrate: fruit thrown into a basket is bruised by the fall, even though the fall be one of only a few inches. The fruit soon begins to rot at

these bruised places. Fruit that is second grade while on the tree, but correctly picked and neatly packed, is worth more, and will usually bring more than the first grade fruit that is bruised in picking or handling, or that is poorly or untidily packed.

Pears should be picked just before they begin to mellow or ripen. They should be picked with the stem on, and carefully placed in small piles, under cover, until they mellow, which usually will be within a week after picking.

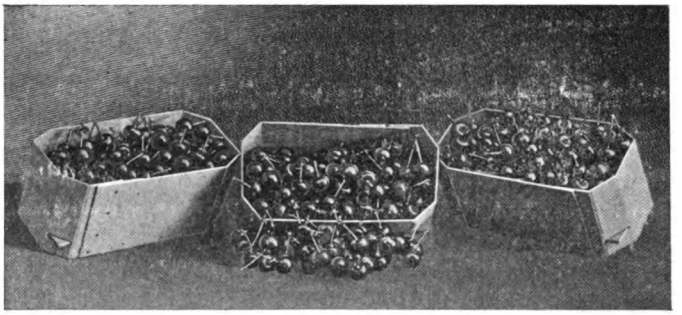
Cherries, *plums*, and *strawberries*, should be picked while dry, and usually just before they are fully ripe. The stage of ripeness at which these fruits should be picked will depend somewhat upon the time required to reach the market with them. When picked they should at once be placed in a cool place in the shade.

Cherries and plums should be picked with the full stem on; strawberries should have the short stem which bears the individual berry, and the "hull" of the berry left on. Strawberries that have the hull pulled off are not marketable.

Following are some of the reasons why the stems should be left on such fruit when it is picked: It keeps better with the stem on; stems hold it in place in the boxes in which it is to be shipped; the stems take up the slack and prevent, in a

measure, the settling and the crushing of the fruit in transportation.

When the fruit is picked, carefully sorted into two or three grades, and neatly packed into baskets or boxes, it is ready for the market.



CHERRIES READY FOR THE MARKET.

CHAPTER IV.

THE SOIL.

INTRODUCTORY.

THE great prairie plow turns over the sod upon which the grass has grown and the wild flowers have bloomed for ages. The farmer plants the corn and sows the wheat, and receives rich returns for his labor. But as the seasons pass, the blades become slender and the stalks small; the ears are no longer large, nor the grains plump and round.

Let us reflect. The grass that waved in the sun of many summers fell each year upon the earth, and strengthened the bosom that nourished it. The flowers that nodded upon the plains, and gave their perfume to the soft air, perished only to give strength and beauty to others of fairer form and sweeter fragrance.

The generous soil has been giving to the farmer, in corn and cotton, the rich stores gathered from blade and flower. These rich gifts have been changed into ear and pod, that the farmer has been yearly gathering.

There is a great law that must be applied here.

It is called the law of compensation. Since the soil has given of her stored wealth, an equivalent must be given to her, or her storehouse becomes empty and her power exhausted.

It has taken much thought, and many years of experience, to learn what may be returned to the soil to repair the drain upon its natural supplies. The proper rotation of crops, the application of needed food supplies, the periods of rest and proper cultivation, are all subjects of the deepest interest, and are considered in the following lessons.

LESSON XV.

STORY OF THE SOIL.

I.

"Father, where did all the land come from?" Henry Patterson asked this question of his father, as they sat on the porch together one summer evening, after the day's work was done.

"Well, Henry," said Mr. Patterson, "that depends. It depends, in the first place, upon what you mean by 'land.' By the word 'land' do you mean all the earth's crust that is not water? You know that the earth's crust is said to be composed of land and water; but the word 'land' when thus used includes the rocky part of the earth's crust as well as the part that is often referred to as soil."

Henry said that by the word "land" he had meant the part that he supposed should be called earth.

"Yes," said Mr. Patterson, "I understand now what you mean. By the word 'land' you mean the soil. I will tell you about it as well as I can. Much of the earth's surface that is now dry land was at one time covered with shallow waters—shallow seas. These shallow waters teemed with low forms of animal and vegetable life. As these animals, mosses, and sea-weeds died, their remains

sank — built up from the bottom — and gradually the earth's crust became thicker in places.

"In time, mountain ranges were formed, and the action of the air and the rain, the sun and the frosts, caused the rocks thus exposed to crumble, and water carried the crumbled rocks from the high places down into the low places. Sea-weeds and sea-mosses grew and decayed with the mass thus deposited; then other plants grew as this mass became enriched by the decay of animal and vegetable life, and in time plants grew in great numbers. Vast forests were buried by floods, and these buried forests were burned into beds of coal by confined heat, just as a stick of wood is changed to charcoal in a stove or in a charcoal pit.

"The air and water, heat and cold, crumbled other rocks, and the crumbled particles, mingled with decayed vegetable and animal remains were carried down by water, and other layers of soil were formed on top of the coal beds and elsewhere. Largely in this way, as the ages have gone by, the layers of soil have been formed by time and tide, life and death, growth and decay.

"This work is still going on. Rocks crumble, or by friction are ground into fine particles; plants convert a portion of this mass into leaves, stems,

and fruit; animals eat the plants, and they are changed to flesh, and finally all these bodies go back to the soil, or to dust whence they came."

2.

Henry was much interested in all this, for he had not before thought much about it.

"You see, then," Mr. Patterson went on, "that soils are composed of two general classes of elements or matter, — the one class being the rock materials, and often called *inorganic;* the other being the decayed remains of animal and plant life, often called *organic* matter."

To help Henry to get this information clearly fixed in his mind, Mr. Patterson made the following diagram: —

1. Soil is composed of
   1. Inorganic matter, such as
      (*a*) Silicon, (*b*) aluminium, (*c*) lime, (*d*) sodium, (*e*) potassium, (*f*) sulphur, (*g*) iron, (*h*) magnesia, etc.
   2. Organic matter, as
      (*a*) Remains of animals, (*b*) remains of plants.

"You have no doubt noticed," continued Mr. Patterson, "that the upper part of the soil in many localities is dark in color. This dark soil is largely

composed of decayed vegetable matter, or humus. Vegetable mold, or humus, is favorable to plant growth, because it is rich in plant foods, and because it tends to keep the soil mellow and moist."

3.

"Do you mean to say, father, that plants need food? How can that be?" The idea that plants require food was entirely new to the boy.

"How could plants live and grow, Henry," asked Mr. Patterson, "if they did not take food?"

"Well," replied Henry, "I suppose they could not, but I had never before thought of it in that way. Do plants take water, too?" Before Mr. Patterson could answer, Henry himself said, "I know they need water! Haven't I seen them die for want of it?"

"While plants do not eat and drink just as animals do," said Mr. Patterson, "still they take food and moisture from the earth and air.

"There are less than one hundred elements known to science," he went on, "less than twenty of these are ever used by plants as food; and of the number used, not more than a half-dozen are used to any great extent.

"Plant food must be in the form of a liquid or a gas, before plants can use it. They use small

quantities of lime, iron, sulphur, silicon, magnesia, etc.; yet all these must be reduced to the form of a liquid or a gas before the plant can take them. The foods most largely used, and supplied mainly through the soil, are nitrogen, phosphoric acid, and potash. Carbon is obtained both through the soil and from the air. These substances are sometimes present in the soil, but not in a form in which the plant can use them; when thus present and unavailable, they may often be rendered available by proper cultivation or management of the soil. If they are not present in the soil, they must be supplied through fertilizers before the crop will grow well."

LESSON XVI.

STORY OF THE SOIL (*Continued*).

I.

"Soils must be in good 'physical' or 'mechanical' condition, too," continued Mr. Patterson. "By this I mean that they must be reasonably mellow; not too wet, and not too dry; and they should contain due proportions of inorganic and organic matter. Soils should not be too loose, neither should they be too hard and compact, because tall growing crops will not stand up well in soils that are too loose; and they will not take good root or grow well in soils too hard or compact.

"Cloddy soils expose large areas of surface to the air and sun, hence they do not retain moisture as well as soils do that are not cloddy.

"Mellow soils expose larger areas of surface to the roots of plants than cloddy soils do. To illustrate: A cubic foot of soil in the form of a cube has six faces that are one foot square, and hence the cube exposes six square feet of surface. Now imagine this cube to be divided into eight cubes; each of these cubes will have six faces that are six inches square; hence each of the smaller cubes will expose three square feet of surface, and the eight will ex-

pose twenty-four square feet in all, that is, four times the surface exposed by the original cube. If each of these smaller cubes is again divided into eight cubes, the result will be sixty-four cubes. Each of these cubes will expose six faces, three inches square, and the sixty-four cubes will expose ninety-six square feet, — that is, sixteen times as many square feet as were exposed by the original cube.

"It now becomes evident that as clods are pulverized the area of surface is tremendously increased, and the roots of the plants can find better lodgment, and will be far better bathed by soil and far better supplied with food and moisture than could prevail in a cloddy soil. A cloddy or compact soil may have within it the elements necessary to plant growth, and may be rendered productive simply by being fined or mellowed. Such a soil may be mellowed by the use of machines; by under-drainage, by fall plowing, or by applying lime, ashes, sand, or other materials that tend to break up the lumps.

"Very loose or leachy soils will sometimes be improved by bringing the particles closer together, that is, by compacting them with machines or by spreading lime upon them. Lime is said to both break down a lumpy soil and to compact a loose or leachy soil; but it should not be used on any soil in large quantities.

"Most fertilizers improve the texture of soils and at the same time add to them plant foods. Proper cultivation or tillage both improves the texture and puts the soil in condition to retain moisture better."

2.

"Do plants need much moisture, father?"

"Yes, Henry, they need a great deal. In fact they need so much that its supply in proper quantities is probably one of the most important, as well as one of the most difficult questions the farmer has to solve. We have no control over the rainfall we receive during a season, and we know that growing crops must be supplied with moisture.

"Fortunately, it is a fact in nature that moisture rises, and that plants get much moisture from below, — that is, from deep in the earth. In other words, the earth may be compared to a great sponge. Rains fall, and much of the water sinks into the earth — is absorbed by it; then, in summer, as the water at the surface is changed to vapor (evaporated) by the sun, and carried away by the air and by the winds, the water that was absorbed, and that is held deeper down in the earth, rises toward the surface, and supplies the fields and the forests with moisture."

"But, father, how can moisture rise? What

makes it rise? I should think it would sink deeper and deeper into the earth! I do not understand this at all." And Henry's tone and manner showed that he was bewildered.

"You have no doubt noted the fact of rising moisture, Henry," replied his father, "but you did not connect it with moisture rising in the soil. Did you ever hold a piece of blotting paper with the edge or corner touching a drop of ink?"

"Quite often, father," said Henry, "and the ink rises in the blotter."

"And if you hang a towel so that one end is in a pan of water, what happens?"

"Why, father, the towel takes up the water, and becomes wet."

"Quite true," answered his father. "And these simple facts show that moisture rises, Henry."

It was then an easy step for Henry to connect his knowledge of these things with rising moisture in the soil.

"Now," continued Mr. Patterson, "I will tell you how you may perform an experiment that will show you the rising of moisture in the soil; an experiment that will prove to you that moisture rises more rapidly, and more evenly, in a soil that is reasonably mellow than it does in a soil that is cloddy. It will show, too, that a top coating of finely pulver-

ized earth checks the rising moisture, and retains it in the soil below it."

Just then Mrs. Patterson came out on the porch and reminded Henry that it was his bedtime. Henry was surprised to know the hour was so late. After his father had promised that he would explain the experiment the next morning, Henry went to bed.

3.

The next morning Mr. Patterson said, "Now, Henry, I have a few minutes to spare, and will tell you how to perform that experiment, and this evening you may tell me what success you had, and what you learned!"

Experiment.

"Take three glass tubes or jars open at both ends; tie screen wire or cheese cloth over one end of each; fill one tube or jar with dry clods; fill another with dry and rather mellow earth, but earth of the same quality of soil as that of which the clods are composed; place two or three inches of clay in the third, and on this clay place a few inches of rather mellow earth, and finally, finish filling this tube or jar with finely pulverized soil. Squeeze or pack the contents of the last tube quite tight, and the samples will be ready.

"Now place two sticks about one inch apart in a wide pan; rest the tubes or jars on these sticks, and pour water into the pan until the water stands higher than the lower openings of the tubes or jars. Standing the tubes on the sticks will allow the water to come in contact with the soil. Note carefully from the beginning in which tube or jar the water rises and dampens the soil the most rapidly; note, also, which soil becomes the most evenly moistened; and observe, especially, what effect the finely pulverized soil has upon the rising moisture, after the moisture reaches it. Then draw some conclusions, if you can, as to how the facts you observe may be made useful in the cultivation of crops."

NOTES.

1. Weigh some moist, fertile earth. Place a part of this earth in a jar and plant some seed or set a young plant in it and observe that the seed or the plant will grow. Place another portion of this earth in a pan and allow it to become thoroughly dry. (*a*) Note the loss in weight occasioned by the evaporation of moisture. (*b*) Place seed or young plants in this dry soil and note that they will not grow. Dampen the soil and the seed will sprout or the plants will grow.

2. Place some fertile soil on a stove. The heat will drive out the moisture and will burn the organic matter out of it. Dampen the burned soil and plant seed or set a young plant in it, and note that there is no growth. Add organic matter in the form of fertilizers and note that growth of the seed or plant will at once begin. A brick is a piece of earth having the organic matter burned out of it, but all bricks are not made from fertile soils.

3. (*a*) Work up a ball of stiff clay with pure water, and another ball of the same clay with lime-water. Allow both to dry. Note that the former will become hard, but the latter will crumble.

(*b*) Work up a ball of stiff, mucky soil with pure water, and another ball with the same kind of water, but sprinkle sand with the muck as it is mixed. Note that upon becoming dry the latter will crumble more readily than the former.

CHAPTER V.

PLANTS. FIELD PRODUCTS.

INTRODUCTORY.

THE soil is the natural home of plants. Their roots grow downward and spread in all directions throughout the soil they penetrate and soon the plant becomes firmly attached to the earth. Their stems grow upward and stretch their long arms out into the air and many of them lift their heads high above the earth.

The roots "feed" in the moist soil in which they live, while the leaves gather nourishment from the refreshing breezes in which they wave. But the sunshine must warm the bosom of the earth, and must kiss the leaf and the flower before the life-force within them can do its work. The summer shower must come and its waters moisten the soil and dissolve the elements of plant foods before the plants can utilize them.

Just how and why this wonderful life-force acts under the influence of sun and rain is not known. However, there is much to be learned about the trees; the flowers are ever a fascinating study;

the grass that covers the plain is an open book; the beauty and the wonders of the plant world reveal to all who study them the touch of a hand Divine.

A study, too, of what may be called the World's Great Products, those products that are the source of employment to so many millions of the world's population, and that furnish much of the food and raiment of the human race, is a study not to be despised. The growing of wheat and corn, of cotton and rice, are co-extensive with civilization. The world is practically fed and clothed by these great staples.

Competition in their production is sharp. All that men have learned, and all that remains to be discovered about these products, will be sought by those who produce them with greater interest as the years go by.

Soils upon which these staples are grown must be replenished as their strength is exhausted; new machines must be invented and new methods constantly sought by which their production may be cheapened and their yield increased. The boys and girls of to-day are to become the farmers of to-morrow. The succeeding lessons are offered as aids along the lines they follow.

LESSON XVII.

THE FAIRIES IN THE TREES.

I.

"It was a quiet day in June. Nature was in bloom, and life was in its glory. I had thrown myself upon a green bank, and was looking at queer shadows of the trees that seemed to be inverted in the brook. They were dancing in the water that rippled over the rocks, but only bowing to each other, or to me, where the water was more quiet.

"I must have been half asleep, for I thought I heard the brook singing as its waters glided over the rocks toward the sea; and there were many voices among the trees, and sounds as of moving wings.

"Once, when I roused a little, I saw a bobolink fly from the tree that shaded me.

"Soon I fancied I heard strange little voices coming from the trunk of a great oak that stood on the opposite bank. As I sank into a deeper quiet, one voice seemed to say: 'I am a little wood cell. I form the trunk of the great tree and the blade of the waving grass. In fact, every plant that grows is made up of cells like me.' Then a chorus of voices came from every tree in the forest, from

the grass, the flowers, the moss, from every plant the voices seemed to shout, —

"'We are plant cells; we form every leaf
And every plant the wide world over;
The trunk of the tree, the wheat in the sheaf,
The bud of the rose, the bloom of the clover.'

"Then the voice that I had first heard spoke once more, but this time in a more serious tone. It said: 'Our inner part is called protein (*pro' tēin*) and forms much of the flesh of animals; it is a sticky or ropy substance and contains the element men call nitrogen. Our outer part, or covering, they call our cell wall, and it is composed of hydrogen, oxygen, and carbon. The substance of our cell wall formed of these elements is called "cellulose."

"'The hydrogen and oxygen of our cell walls we get from the water that comes to us largely from the soil through the roots; but the most of our carbon comes from the air through the leaves of the plants we form.'

"And the leaves nodded and waved; and fairy voices came from every one of them, shouting, 'Yes, yes, yes, we furnish the cell with the carbon that makes coal for men.'

"Then all the leaves were still but one, and its voice was gentle and sweet. It said, 'Yes, we ab-

sorb the carbonic acid gas from the air, and the sunshine does the rest.' Then it turned its face to the sun, as if to say, 'Kiss me, sunshine, and I will keep the carbon for the little cell, and will give the oxygen back to the air.' And again all the leaves waved and murmured to the passing breeze, as if rejoicing in their usefulness.

"'When autumn comes,' continued the voice from the leaf, 'we fall to the ground and cover it. We protect it from the sun and prevent the escape of moisture; we decay and give back to the soil the potash and the nitrogen we contain, and — and — ' but the words were lost, the sound was carried away by the breeze that brought a delightful fragrance, and I heard faint voices that came from the flowery bank across the stream, — from daisies and violets, sweet-williams and buttercups, bluebells and roses, — all giving their fragrance to the air, all lending their beauty to the scene."

2.

"'We furnish the pollen that fertilizes the seed,' cried a voice.

"'And we bear the nectar that attracts the honeybee,' said another.

"'Yes,' chimed in a third, 'and as the bee sips at the nectar fount, we cover its legs with our pol-

len which it carries to other flowers of our kind; in this the bee is our special friend and helper.'

"'That is true,' cried another; 'and many seeds would never grow — would never even form, if the friendly wind did not come and carry our pollen on its wings and give it to our friends.'

"Then all the little flowers blushed and turned their faces aside, and the voices seemed to say, 'We did not mean to boast, we were only happy and rejoicing to know that we are useful in the world.'

"And the sweetness of the fairy voices was wonderful as they joined in the chorus song: —

"'With shadowy forms, on wings of air,
We came from endless time and space;
Our Goddess, Ceres, wondrous fair,
Is mother of our fairy race.
Hail! fair Goddess, Ceres,
Hail! great Father, Time;
Love is the power that binds us,
Love is the power Divine.'

"But the shrill 'caw' of a crow roused me. I rubbed my eyes, and as I arose I realized that I was Henry Patterson; and I knew that I had been dreaming of what my father had told me the evening before about plants and plant growth.

"Father laughed when I told him my odd expe-

rience. He said, however, that there was danger in lying down on the ground and going to sleep. One is likely to take cold if there is dampness in the grass or leaves. Since then I have been more cautious about going to sleep on the ground."

3. NOTES.

1. *The Cell.* Cells form the real fabric and working machinery of the plant. As a workman handles wood, iron, mortar, and other materials with which to construct buildings, so do plant cells appear to hold or carry materials other than those of which they are really (chemically) composed, such as starch, sugar, phosphoric acid, potash, and small quantities of some other substances.

The starch and sugar carried by the cells are almost identical with the cellulose of the cell itself. These substances are stored in the grain, the bulb, or the stem of the plant, where they serve to nourish the young plant until it is old enough to secure food through the roots from the soil, or through its leaves from the air. Thus stored, they also serve as animal food.

The phosphoric acid carried by the cells is largely deposited in the grain, whence it becomes the

source of much of the phosphorus in the bones of animals.

The potash they carry is represented by the ashes of the plant.

The presence of starch is readily detected by the color test.

Experiment. Pour diluted iodine on a piece of potato, turnip, onion, or in flour, meal, etc., and the starch in them will turn blue.

There is a certain circulation within the cell. This may be observed by making the following test.

Experiment. Place a small piece of any water plant, any leaf, or piece of wood under a microscope.

Observe the cells and the circulation beneath the cell wall, that is, within the cell.

2. *Rise of Moisture in Soil and Plants.* Liquids rise in small openings by a force called *capillary attraction.*

Experiment. Place two or more glass tubes of different size bore, and open at both ends, vertically in water. Observe that the water rises in each tube, but rises highest in the smallest tube.

Liquids rise by passing through a membrane and mixing with some other liquid by a force called *osmose.*

Experiment. Fill a glass jar that has a wide opening at top nearly full of water. Fill a thin leather bag, or a bladder, with oil (other than coal oil), such as machine oil, or lard oil. Rest the bag or bladder of oil on the jar so that it touches the water. Observe that the water passes through the membrane up into the oil.

Experiment. Make a small hole in the little end of an egg through to the white of the egg. Insert a small glass tube in this hole, and close around the tube with sealing wax where it enters the egg, making it air tight. Then break the shell on the big end of the egg, but not the membrane that lines the shell, making a hole in the shell as large as a silver quarter. Rest the egg, large end down, on the wide mouth of the jar or bottle filled with water, so that the membrane touches the water.

Observe that the water will rise in the egg through the membrane, and that the white of the egg will rise in the tube.

This illustrates both the passing of moisture in through the bark of the root of the plant by *osmose*, and the rise of sap in the plant by *capillary attraction*.

LESSON XVIII.

THE LITTLE EAR AND ITS BIG FRIEND.

I.

"'O dear me! I cannot get my nose out! I cannot get my breath! What shall I do? What shall I do?'

"These words came, in a piping little voice, from a stalk of corn that grew just over the fence in a neighboring field.

"I was a big ear, and my nose was sticking out from under the husk that once covered me. As I looked through a crack in the fence I could see the poor little ear that had cried out so piteously.

"There were six or seven stalks growing together, but only one stalk bore an ear, and that was the small ear that was crying. Again it cried, 'O dear! O dear! What shall I do?'

"I was fast upon my stem and could not go to its relief. I begged of it, after a kindly greeting, to confide to me its history so that I might be of greater service.

"'O yes, to be sure,' said the little ear, in a much cheerier tone, 'your voice seems kind. I trust you may help me.

"'Once my ancestry were fine large ears, like

many others that grew with them; but year after year they have been planted in this same soil, and now I can find no food in it, nothing to give me strength. Each year the soil has become less mellow and more unfriendly. Last year I was planted among the clods. I have struggled all summer long, until I am tired out.'

"The little ear sobbed and cried again, but its sobs were quickly changed to cries of delight when I told it that only a few days before I had heard its master say he was going to give the soil on which it grew a few years' rest, and plant his corn next spring on fresh, rich land.

"'That will be delightful,' shouted the little ear.

"Just then a gentle breeze rustled the blades of the stalk on which it grew. The little stalk was clapping its hands for joy.

"Then, remembering the past, it added: 'If my master had only allowed me to follow a crop of oats, or wheat, or clover, or grass, I should have grown much faster and should have yielded much more grain. I should have been sounder, too, and the worms would not have hurt me so badly.'

"I did not chide the little ear for its complaint, for I knew its struggle had been great, and its courage sorely tried. I said to it, 'Cheer up, little ear; soon the nipping frost will come and kill the worm

that bites you; and as soon as you are dry enough, your master will put you in a good warm crib.'

"Sure enough, that very night a cold wind blew from the north. The hoar frost made mountains in the soil, and sparkled like diamonds on the blades; and on the ears formed little soldiers, with broadswords in their hands. We all knew that harvest time was near. I heard nothing more of the little ear save now and then a merry laugh and song, as the wind blew from the direction in which I had first heard the voice, and I was sure it was happy in the hope of a higher and better life."

2. NOTES.

1. *Soil.* Corn requires a rich soil. Soil that is not very fertile should be fertilized. This may be cheaply done by spreading barnyard manure over it, or by occasionally plowing under a crop of green clover. Too many crops should not be grown in succession upon the same soil, however fertile it may be. One crop of corn to two or more crops of small grain or grass will not only assist in preserving the soil, but will tend to keep it free from weeds and insects that may be injurious to the corn.
2. *Preparation of the Soil.* The first thing to do in the preparation of the soil in which corn

is to be planted, is to plow it. Plowing is usually done in the spring, just before the corn is to be planted; but corn will grow well on land plowed in the fall, if the season is favorable. If the weather is dry when the ears are forming, the corn will "fire," that is, the blades will die and the stalks wither before the grain matures. Land that is plowed in the fall should be disked, or cultivated, and harrowed well in the spring, before the seed is planted. When the land is plowed in the spring, it can usually be pulverized with the harrow. The time required for cultivation and the amount of labor necessary will be much reduced, and the yield of corn largely increased, by putting the soil in good condition before planting the seed.

3. *Planting.* Corn should usually be checked, that is, it should be planted so that it may be cultivated in more than one direction.

Cultivating in more than one direction rids the land of weeds and pulverizes the soil better than is possible if the corn is not checked.

Corn is usually planted at regular intervals, from three feet eight inches to four feet apart, in what are called hills. From two to four

grains are planted in a hill. In fertile soil, the hills are sometimes made twelve to twenty inches apart in the row, and one or two grains only planted in a hill, the rows being the usual distance apart. This is called drilling the corn.

4. *Cultivating.* Corn may be harrowed before it sprouts. After it has come through the ground, it may be harrowed until it is several inches high.

The harrow not only destroys the small weeds, but it also pulverizes the soil. The land should not lie long without being cultivated after the corn has come through the ground, but should be kept mellow and free from weeds.

As a sponge absorbs water, so will a porous soil absorb moisture from the damp earth below it. A blanket or covering of loose soil retards evaporation. For these reasons, moisture will always be found and kept nearer the corn roots in soil that has been made mellow by deep breaking, and that is kept finely pulverized on the surface by cultivation during dry weather, than in soil that is not cultivated, as meadow land, waste fields, or even land plowed but not frequently cultivated on the surface. The mulch of earth upon the sur-

face, kept loose by frequent cultivation, makes the blanket or covering that retards evaporation. The cultivation during dry weather should not be too close to the corn, however, but the "middles" — the spaces between the rows — should be frequently stirred.

Corn that is weedy will not ear well. Weeds that grow between the rows may be plowed out, but weeds that grow in the hills must be pulled out or covered up.

5. *Harvesting.* Corn should not be put in bulk until it is well cured. It may be husked from the stalk and cribbed, or it may be pulled or "snapped" off, and cribbed with the husk on the ear. Husked corn requires less crib room, and is in better condition for feeding and handling than corn that is not husked; and for these and some other reasons, the better plan or method is to husk the corn from the stalk, and throw it directly into the wagon box, and thence to the crib.

The crib should be strongly built. The sides may be somewhat open when intended for corn not shelled, but the roof should be "water proof," that is, it should not leak; for when corn gets wet or damp in the bulk, it frequently heats and becomes worthless.

Corn is also harvested by being cut and put into shocks. When harvested in this way, it should not be cut while green, neither should it be allowed to get too ripe. If cut too green, it lacks nourishment, and both the grain and the fodder may mold in the shock; if allowed to become too ripe, it lacks flavor, and there is a loss in blades from falling and crumbling. When the grains have taken on a glaze, or when they plainly show the dent or pit, when the husks turn brown and indicate a ripening, when the lower blades are ripe and the upper blades are turning from a green to a golden hue, then the harvest time is at hand, and the corn may be safely cut.

After the shocks have wilted or dried for a day or two, they should be securely tied, well toward the top, to prevent twisting or falling down.

When corn is harvested in this manner, it furnishes a large amount of excellent stock food that is in a condition for use in a variety of forms. For example, it may be fed from the shock without being husked; or the corn may be husked from it and cribbed, and the fodder reshocked in the field for winter use. Or it may be shredded, that is, run through a ma-

chine called a shredder, which husks the corn from the fodder and then cuts and tears the stalks and blades into bits or shreds. The fodder thus shredded may be ricked in the open, or it may be placed in bulk in a mow or under a shed. Shredded fodder should be thoroughly dry before it is ricked or bulked, for if shredded and placed in bulk before it is well cured, it may mold and become of little value.

Corn may be cut, and the entire product run through a shredder or cutter, and immediately placed in a silo. In this way it is preserved green for winter use.

Earth makes a good bottom or floor for the silo. The wall should be strongly built to prevent bulging or springing, and the inside surface of the wall should be made smooth, so that the contents may settle evenly. The silo should be made from twenty to twenty-five feet high, in order to get necessary pressure in the weight of the silage to exclude the air. The doors or openings in the sides should be one above another, and not too far apart. As the green corn is cut (or shredded) it should be carefully placed or packed in layers, the silo being filled from the bottom upward and

always emptied from the top downward. When the silo is full a few buckets of water may be thrown upon the top layer; this will hasten the formation of an air-tight covering of rotten silage, which will protect the rest from the action of the air. When the silage is desired for winter use, the rotted covering may be thrown off.

The exclusion of air from silage preserves it; hence the use of salt or other preservative is unnecessary.

Doors above the upper surface of the silage should be left open for ventilation; but the doors below the surface should be kept closed "air tight." Corn should be cut at about the same stage of ripeness for silage as for shock-cured fodder. In feeding cattle, some dry food should be given with the green silage.

3.

6. *Vocabulary.*

corn, — the entire maize plant, including stalk, blades, and ears, also the grain this plant produces. (In England, wheat, oats, barley, etc., are called corn. In Scotland, oats are called corn.)

115-Ton Silo.
At the Missouri University Experiment Station. Cost, complete, $174.

corn husk (or shuck), — the entire outer covering of the ear, that is, the part to be removed in husking the corn.

corn tassel, — the head or top part of the stalk, composed of spikes, which bear the male flower and the pollen.

corn silk, — the delicate threads at the end of the ear that bear the female flowers of the plant, which receive the pollen as it falls or is blown from the tassel.

corn stalk, — the main stem upon which the ear and blades of corn grow.

corn fodder (or fodder corn), — the entire plant, cured, including the ear.

corn stover, — the cured plant, after the ear has been removed.

corn silage, (frequently called ensilage), — corn fodder preserved green.

silo, — a strong, practically air-tight structure, in which corn fodder (or other rough forage) is preserved green.

siloing, — the process or act of putting green forage into the silo state.

mulch, — a loose covering for the soil to retard or arrest the escape of moisture by evaporation. Pulverized earth serves well as a mulch. Straw, hay, sawdust, etc., are also used as mulches.

LESSON XIX.

COTTON.

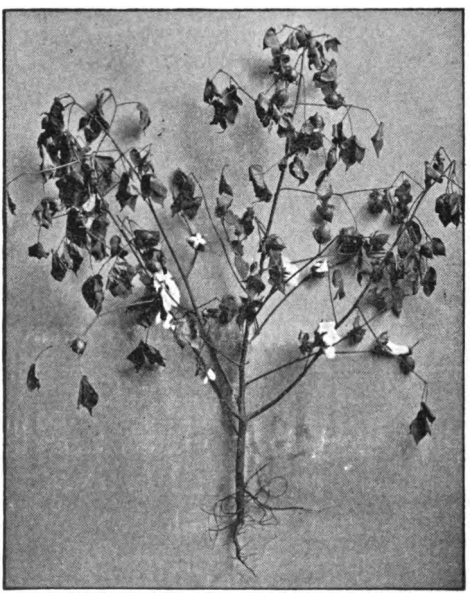
1.

Cotton is an important vegetable fiber. It is a native of warm climates, but because of its value, it has been acclimated to higher latitudes, and is now extensively cultivated far into the temperate zones.

The plant grows to a height of from three to seven feet. Many branches spring from the main stalk; these branches subdivide, and most of the subdivisions bear numerous white, yellow, or purple flowers. Very soon a pod or "boll" takes the place of the flower. Each pod or boll has from three to five cells, and each cell contains a number of seeds. To each of these seeds is attached a large number of delicate white fibers. These fibers form the cotton of commerce. As the seeds ripen, the bolls spring open, the fibers unfold, and soon the hills and vales of the cotton fields look like a mass of living snow. Branches continue to grow out from the stem of the plant, and blossoms continue to appear as the season advances; hence all the cotton bolls do not open at the same time.

The open boll, the maturing pod, and branches

sending out their blossoms are all found on the plant after the cotton begins to ripen.



COTTON PLANT, WITH BLOSSOMS AND BOLLS.

Both the cultivation of cotton and its conversion into the finished product have been largely cheapened during recent years by the invention of machinery. It has also been lately discovered that the seed contains valuable oils, and that the residue of the seed, after the oils have been pressed out or extracted, is valuable as stock foods (called cotton

cake, cotton-seed meal, etc.). The cotton-seed meal is also largely used as a fertilizer.

2.

Ground that is not too rolling should be plowed early in the season; it should be well disked, or cultivated, and pulverized just before it is seeded.

The labor required in cultivating the crop will be reduced, and the yield of cotton will be increased, by putting the soil into good condition before the seed is planted.

The methods of preparing the soil and planting the seed will depend to some extent upon the character of the soil and its slope. Land that is rolling, and that washes badly, requires a special preparation that can only be learned through experience. Land that is flat, and upon which water might stand for a time after a rain has fallen, is generally "listed" after the seed bed has been prepared, and before the cotton is planted. This listing consists in making small ridges in which the seeds are planted.

Some soils must be fertilized before they will produce the largest yield. For this purpose, well-rotted stable manure is probably the best, but prepared fertilizers are extensively sold. When stable manure is used, it may be spread upon the soil and

plowed under, or it may be spread after the land has been plowed. If prepared fertilizer is used, it may be distributed in rows, either before the cotton is planted, or along with the seed as they are deposited.

The following is the most economic method. Use a two-horse seeder that is provided with boxes for grain and with a box or boxes for fertilizer. All these should so open into the shoes that the seed and fertilizer, if fertilizer is used, are deposited and covered together or near each other. If the land is to be listed, a lister may be attached in front of each shoe. In this way, two rows are listed, fertilized, and planted at each "through"; and thus the largest amount of work is done in the best manner, at least expense. In seeding rough or very rolling land, more laborious and hence more expensive methods must be employed than that above described.

Much rainfall after cotton is planted, and before it comes through the ground, will cause a crust to form over the surface of the seed bed, through which the tender sprouts cannot force their way. Cultivating the surface of the soil with a light spring-toothed harrow or horse rake will break the crust and enable the sprouts to come through.

The regular cultivation of the plants should

begin as soon as they are through the ground. While the plants are small the middles may be kept mellow and free from weeds by the use of harrows and cultivators with narrow shovels. Wider shovels may be substituted for the narrow as the season advances. Many successful planters use the narrow shovel, however, during the entire period of cultivation, with satisfactory results. The cultivation should be thorough, and the soil should be kept mellow and free from weeds.

It is much easier to remove plants when they stand too thick in the row than to supply plants that may be missing. For this reason the seeds are usually drilled close together, and when the plants are a few inches high they are thinned until they stand one in a place, and from eight to twelve inches apart in the row. Formerly the surplus plants were cut out with a hoe and the process was called "chopping" the cotton. In many localities this work is now done with machines drawn by horses.

When the cotton is ripe it is picked from the pods and put into sacks. It is then carted to the cotton gin, where the seeds are separated from the cotton fiber. The fiber is then pressed into large bundles called bales. Each bale weighs about five hundred pounds. The bales are sent to mills,

PICKING COTTON.

where the cotton is spun into threads and woven into cloth.

Coarse muslins, tentings, etc., are made from the coarser grades. Fine muslins, calicoes, etc., are made from the finer grades. Sea-island thread, fine laces, and fabrics are made from the very fine quality of cotton which is grown on the low sandy islands along the coast of South Carolina, Georgia, and Florida, and which grows to some extent on a part of the mainland of these states.

3. NOTES.

1. America produces more cotton than any other country. Strangely enough, much of the cotton produced in this country, and nearly all that is grown in Egypt, India, China, Brazil, and other cotton-growing countries, is shipped to England, France, or Germany to be manufactured into thread and fabrics. New York, Boston, Savannah, Charleston, New Orleans, and Galveston are leading ports from which cotton is exported.
2. It is only of late years that the seed of cotton has been utilized. The lard, the lubricating oils, the stock foods, and the fertilizers now made from them give them a commercial value of from twenty to forty cents per bushel. The stems of the plants make a fine grade of linen paper.
3. Following are the distinct types of cotton: (1) cluster; (2) long limbed; (3) long staple; (4) short staple. There are many varieties of each type. The short staple is best adapted to upland. The long staple requires a special soil and a favorable season.

LESSON XX.

WHEAT.

I.

Wheat will grow well in many kinds of soil, and in cold, temperate, and warm climates. The grain supplies food for both man and beast. The bran, as the wheat hull is called, is a good food for animals; while the straw is not only a stock food, but is used in making paper, in making straw hats, strawboard, and many other useful things. These facts make it clear why wheat is grown by the people of so many countries and in climates differing so widely.

Some farms will produce many more bushels of wheat to the area than others. This difference in yield depends chiefly upon difference in soil, difference in climate, and difference in the methods employed by those who plant and harvest this useful crop. A heavy growth of straw sometimes bears a small supply of imperfect grain. The wise farmer knows there is a reason or cause for this. He knows that his soil needs minerals.

To supply these, he has loads of bones ground to meal and spreads this over his fields. He knows that in Florida and the Carolinas there are great beds of glassy-looking rocks called phosphoric rocks

or phosphoric beds. These rocks contain phosphoric acid, and when pulverized they form a good mineral fertilizer which is shipped to all parts of the country. From bones, and from phosphoric rocks, then, he knows that one of the minerals (phosphoric acid) needed by his soil can be obtained.

Potash is the other mineral that plants use largely, and this he knows is contained in wood ashes, which he also hauls and spreads on his soil.

On the other hand, if the plant shows a small blade or spindling stem, if it lacks in vigor and color, he knows that nitrogen should be added to the soil, and he spreads barnyard manure, cotton-seed meal, dried blood, etc., over it, for these all contain the needed nitrogen.

Barnyard manure not only contains nitrogen stored in its vegetable matter (humus), but it also contains a small amount of phosphoric acid and potash, and is an excellent fertilizer for thin or badly worn soil. It is well to cover this fertilizer by plowing it under.

Some fertilizers may be scattered over the surface of the field and covered by harrowing, or they may be drilled in the earth near the grain.

Every farmer finds it profitable to study the character of the soil he is cultivating and the character of the fertilizer it may require.

2.

The time for seeding land in wheat depends chiefly upon climate. In some latitudes, mainly northern, almost the entire acreage is seeded in the spring of the year; in other latitudes seeding is done in the fall.

Wheat planted in the fall, and harvested the following summer, is called fall wheat; while wheat that is planted in the spring and harvested in the summer is called spring wheat.

Successful wheat growers in many countries plow the ground a month or more before seeding time. They think that early plowing allows the soil to become firm and compact and the moisture to rise nearer the surface, so that the wheat will come up more promptly if there should be a drought. They think, too, that early plowing renders the plant foods of the soil in a condition in which the plants can more readily use them, and that it largely frees the soil from insect eggs that may have been deposited.

If a drought is feared, it is well to harrow the land as soon as it is plowed. This will create a coating or mulch of mellow top soil which will arrest the escape of moisture through evaporation. Land early plowed should be disked, or cultivated,

and well mellowed before it is seeded. Seeding is done best and cheapest with a drill.

The wheat used for seed should be sound and free from foreign seed. The soil may be left somewhat uneven on the surface after seeding.

3. NOTES.

1. There is a wide difference in the methods of harvesting wheat. The method to be used will depend largely upon the physical features of the country, the climate, etc. In some localities the crop is headed, and the heads are either hauled and placed in heaps for a time, or else they are hauled direct to a thresher, where the grain is threshed from them and placed in sacks. In other localities the wheat is cut and bound into bundles, called sheaves. Eight to twenty of these sheaves are placed together in an upright position to form shocks. The shocks are usually allowed to stand in the field for some days, so that the straw may cure and the grain dry. The crop is then either hauled to the machine and threshed, or else placed in a stack, or in bulk under a shed.
2. Wheat placed in bulk, either before it has been threshed, or after threshing, soon passes into

what is called a "sweat." If the bulk is large, the grain sometimes spoils from overheating. For this reason small compartments in bins are recommended. Stirring wheat with a shovel, or changing it from one compartment or bin to another while the grain is in the sweat, will often prevent injury. Pine laths placed in the wheat will also help to dry the grain by absorbing moisture.

3. Frequent rotation of crops is quite as necessary in the production of wheat as it is in the production of corn. Proper rotation not only "rests" the land, but it also frees it in a great measure from insects and wheat diseases.

   A crop of clover or a crop of cowpeas may, with profit, precede a crop of wheat. These are especially good rotating crops, because of the nitrogen they supply, and the shade they afford to the soil.

4. Varieties of wheat (or other cereals) do not deteriorate (run out) as quickly as many persons suppose. In fact, most varieties may be improved by careful cultivation. There are dangers attending a change of seed. The farmer who has a good variety should be slow to change to a variety not known to be adapted to his soil, and not known to be free

from foreign seed, smut, etc. Wheat does not always yield well under conditions that are new to it; and seed that is bought at random often proves disappointing, even undesirable. When a change is thought to be necessary, the safest plan is to procure seed from some reliable and careful farmer in the neighborhood, — a variety which he can recommend, and which is known to be free from such foreign seed as wild oats, cockle, Russian thistle, mustard, cheat, etc.

5. Following are a few varieties of wheat in common use: —

FALL WHEAT.

1. *Fultz.* — Bald; red; about 70 grains in a head.
2. *Hybrid Mediterranean.* — Bearded (some varieties bald); red, (some varieties white); about 24 grains in a head.
3. *Fulcaster.* — Bearded; red; about 24 grains in a head.
4. *Michigan Amber.* — Bald; red; about 48 grains in a head.
5. *Canadian Amber.* — Bald; hardy.
6. *Turkey Red.* — Bearded; red.
7. *Winter Bluestem.* — Large berry; long head; yields well.
8. *Red Cross.* — Large berry; red; yields well.
9. *Dawson's Golden Chaff.* — White; bald; yields well.
10. *Early Genesee Giant.* — White; bearded; yields well.

SPRING WHEAT.

1. *Wild Goose.* — Long straw; large head; bearded; very hard; large berry.

2. *Red Fife.* — Long heads; bearded: grain red; very hard, and of excellent milling quality.
3. *Medeah.* — Very long straw; large, square heads; black beards; very large, hard berry; very early.
4. *Herison Bearded.* — Short, square head; small, plump berry; red; medium soft; weighs about 63 pounds per measured bushel.
5. *Hayne's Bluestem.* — Long berry; hard; chaff covered with minute hairs, which has led to the common term, "velvet chaff wheat."

LESSON XXI.

RICE.

I.

Rice is probably the oldest of cultivated cereals, — its culture dating back to nearly three thousand years before the Christian era. It forms the principal food of half the population of the world. Because of its extensive cultivation and use as a food product it is often called "the world's greatest cereal."

There are many hundreds of varieties, but the "gold seed" or yellow rice is the variety now chiefly cultivated in this country.

Most varieties grow best on lowland, yet a few kinds are grown on upland. The best rice land is a clay loam having a heavy or stiff subsoil or under clay soil.

Average rice land will produce from eight to twelve sacks or barrels of rice, of 162 pounds each, per acre, at a cost of production of from $25 to $40 per acre. The product is worth to the producer from three cents to six cents per pound in the market. The by-products, as the stem, hull, etc., are called, add something to the value of the crop. The by-products are chiefly valuable as fertilizers.

Rice land is usually plowed just before it is seeded. The surface is thoroughly pulverized before seeding begins.

The earlier method of planting was to sow the seed broadcast; but the modern drill distributes the seed more evenly and covers it better than can be accomplished by broadcast sowing, and is preferable.

Seed rice is always carefully selected with special effort to securing uniformity in the size of the grains. Great pains are also taken to select seed that is free from red rice, from grass, and other foreign seed. From one to three bushels are sown to the acre, the amount varying with the locality, character of the soil, etc.

Rice fields vary in size from one acre to eighty acres. Small fields are preferable for two reasons. Small plots of ground may be selected that have level surfaces, and these allow more even flooding than large fields, on account of the unevenness of level that is likely to obtain in a large field. Small plots may be sown one after another; then the plots ripen and may be harvested in the order in which they were sown, and thus the harvest of the entire crop does not come on at the same time.

2.

Irrigating or flooding is the most important process in rice culture. If the land is sufficiently moist at seeding time to sprout the seed, it is usually unnecessary to flood the land until after the rice is six or eight inches high. Then the water is turned on from the irrigating ditches until it stands from three to six inches deep over the field. The water is kept fresh by a constant inflow and outflow. All water is withdrawn several days before harvest, so that the ground will dry and become firm before harvest begins.

The methods of flooding vary, however, in different localities. In some sections of the country the land is flooded as soon as the rice is planted. This "sprout-water," as it is called, is allowed to remain on the ground until the seed sprouts; then it is withdrawn.

Sometimes it is let on again within a few days and allowed to remain a short time, and is again withdrawn. When the plant has two leaves, the "stretch water" or "long point flow" is put on and allowed to remain for a month, when it is drawn and the crop is hoed. When jointing begins the "lay-by flow" is turned on and remains until a few days before harvest time.

Harvest begins as soon as the straw commences to show yellow at the bottom. The crop is harvested and threshed in very much the same manner as wheat.

The rough rice as it comes from the thresher is called "paddy," and has to be milled to remove the husk from the grain. The "milling stones" used in milling rice are set about two-thirds of the length of the grain apart, and the stones rapidly revolved. After the rice is milled the grain is of a mixed white and yellow color. In order to remove the outer skin, it is put into mortars that hold five or six bushels each, and in these it is pounded with pestles that weigh from three hundred to four hundred pounds. The flour and chaff are then removed from the grain by screening and fanning, and the rice is allowed to cool. In a few hours the grain is cool and is passed over brush screens, and the small grains separated from the large ones, and all is thoroughly cleaned, ready for the last process — polishing.

Polishing is accomplished by placing the grain in double cylinders of wood and wire gauze, around which are tacked pieces of tanned sheepskin that have been worked until they are very soft. These cylinders revolve, and friction gives the grain the pearly white appearance or polish required. After

the grain is polished it is passed over screens and separated into grades. It is then sacked ready for the market.

3. NOTES.

1. For a long time rotation of crops was not considered necessary in rice culture. Experience has taught that not only is rotation of crops beneficial, but that rice land must be fertilized if continuous production is expected.
2. Burning rice straw and rice hulls is very wasteful. These make good fertilizers for the rice fields, and good mulches for gardens, small fruits, and orchards.
3. A forage crop planted after the rice crop is harvested is not only a source of profit as forage, but mellows the soil and rids it of red rice, weeds, and grass.

   Oats, corn, crimson clover, etc., make good forage crops to follow rice. The field should be plowed after the red rice and weeds have come up, but before these have formed seed. The land may then be allowed to lie in fallow for a time. It is then well disked, and the forage crop is planted in time to produce winter pasture.

LESSON XXII.

TOBACCO.

I.

Tobacco is an important crop in many countries. In the United States it is extensively grown throughout the Virginias, and the Atlantic and the Gulf states south; in Kentucky, Southern Ohio, Tennessee, Arkansas, and Central Missouri; in sections of New York, Connecticut, Maryland, and Pennsylvania. A few varieties mature as far north as Wisconsin.

When grown in fresh, rich soil that does not require fertilizing, tobacco is a profitable crop; but it is a crop that draws heavily from the soil and soon impoverishes it. Soil once impoverished from having had too many crops of tobacco grown upon it, must be fertilized before it will again produce well.

It is almost a universal custom to "burn" beds in which the plants are to be grown until large enough to be set in rows in the field where they are matured. A protected spot, having a southern slope or exposure, is usually selected for the bed. On this spot, brush and logs are piled, — sometimes upon the ground; sometimes upon some poles

placed a foot or two apart, to afford a passage of air under the fuel. Fire is applied to the leeward, or on the side away from the wind, so that the heat may be steady. Fuel is added from time to time, until the underlying earth is thoroughly warmed. After the bed has cooled sufficiently to be worked, it is cultivated with a spade, or hoe, to a depth of about two inches, and the surface pulverized before the seed is sown. The seed should be covered lightly by passing a rake, or a bushy limb, backward and forward a few times over the surface of the bed. Seed thus sown should come up in about two weeks, and in from four to six weeks the plants will be large enough to be set in the field where they are to be matured.

The field should be plowed in the fall, and should be disked, and thoroughly mellowed with the harrow in the spring, before the plants are set. The rows should be from three to four feet apart, and the plants from two to four feet in the rows. Some planters mark off the land into blocks about three feet and a half square, and set the plants so they may be cultivated in two directions. A small amount of fertilizer may be placed in the earth under each plant when the plants are transferred from the seed bed to the field.

The cultivation should be shallow. The middles,

or spaces between the rows, should be kept mellow and free from weeds. While the plants are small, this may be done by the frequent use of harrows, plows, etc. The earth near the plants must be kept mellow, and free from weeds and grass, by hoeing.

Growing tobacco is often infested by caterpillars, corresponding in color to the color of the leaves on which they feed. If these are not removed, they soon damage the crop; hence, it is necessary frequently to examine the leaves and destroy all larvæ and eggs that may be found on them. This is called "worming" the tobacco.

Tobacco must also be "topped" and "suckered." Topping tobacco consists in breaking or cutting the top from the main stalk or stem of each plant (reserving a few seed plants). Small varieties are so topped that from ten to fourteen leaves are left upon the stalk; from sixteen to twenty-four leaves are left on strong plants growing in rich soil. The purpose of topping is to remove the seed head, so that all nourishment drawn from the earth and air may go to the remaining leaves.

Soon after the plants are topped, suckers will grow from the stems at the points where the leaves grow or spring from them. These suckers must be removed whenever they appear, for if not re-

moved, they will draw nourishment from the stem, that should go to the leaves.

2.

As tobacco ripens, the leaves of most varieties gradually assume a light or golden color, and take on something of a smoother, softer feel to the touch. The proper time for harvesting the crop can only be learned by experience in tobacco culture. If harvested while too green, there is loss in weight, and the quality of the product is unfavorably affected.

The harvesting of the ripened crop is usually accomplished in the following manner. An operator approaches a plant from one side, raises the bottom leaves of the plant on that side, and with the leaves thus raised and rested upon the arm, he grasps the stalk with the hand. He then strikes the stalk near the ground with a cleaver held in the other hand and severs it. While the plants are freshly cut their leaves are turgid and easily injured. For this reason the plants are either left lying on the ground for some hours after they have been cut, or else put upon laths, or tobacco sticks, and hung upon temporary scaffolds to wilt. The latter method is generally used with the finer grades grown for cigar wrappers, to avoid any injury to

the leaves that might occur from their contact with the damp earth.

When wilted, the plants are carted to the tobacco house and there hung up to cure. When a partial sun cure is desired, the wilting-scaffolds are placed near a shed. At night, or upon the approach of rain, the tobacco is removed to the shed and then returned to the drying-scaffold each day, or after the shower is over, until ready to be hung in the tobacco house.

Plants should not be cut in the early morning while the dew is on the leaves, because the moisture will cause black spots to appear on them. The leaves sometimes sunburn if the plants are cut near midday.

The bottom or ground leaves usually ripen first, and in some localities the better grades of these are pulled off and hung to dry, before the majority of the leaves have ripened.

Usually in from ten to twenty weeks after the crop has been placed in the drying-house, the leaves are thoroughly cured. They are then pulled from the stems and tied in bunches called "hands"; these are "bulked," that is, they are placed in piles, and are usually covered with boards upon which weights are placed. The hands are finally taken from the bulk and "prized"; that is, pressed into

hogsheads, or strong casks, — in this form the crop is marketed. At the factory the hands are converted into the finished product — plug tobacco, cigars, etc.

3. NOTES.

1. Nicotine is the active principle in tobacco. It is a virulent narcotic or irritant poison. It acts upon the nerves, spinal chord, and brain.
2. Many governments tax tobacco, it being a luxury, and not a food plant. The tax is usually levied on the finished product, and the boxes in which it is placed are stamped on the outside with what are called revenue stamps. These stamps are bought from the government by the manufacturer. When a box containing the finished product is emptied, the stamp on the box must be destroyed, so that it may not be used again. The money that is paid for these stamps is called "revenue," and goes to the support of the government levying the tax. When tobacco is shipped from one country to another a charge or duty is often levied upon it by the country into which it is shipped. This is called a "tariff," and goes to support the government that levies it.

3. Following are a few of the many varieties of tobacco in common use: —

1. *White Burley.* — Early; good color; popular.
2. *Prince Bismarck.* — Cures easily; popular.
3. *General Grant.* — Very early; fine grained; productive.
4. *Sweet, or Yellow Orinoco.* — Good color; popular for home use.
5. *Havana.* — Large leaf; fine texture; yields well.
6. *Sumatra.* — Narrow leaf; tall grower; yields well.
7. *Connecticut Seed Leaf.* — Hardy; yields well.
8. *Hyco.* — Good color; sells well.
9. *Havana Seed.* — Fine texture; delicate flavor; popular.
10. *Yellow Orinoco.* — Long, narrow leaf; fine texture; very sweet.
11. *Pryor* (yellow, white, or blue). — Large leaf; good color; weighs well.
12. *Perique.* — Fine fiber; gummy; adapted to Louisiana.

4. Following are the types of export tobacco, given in the order of color, the darkest first: —

1. *German.* — Heavy, strong, tough, elastic leaf; eighteen or twenty inches long.
2. *Italian.* — Smooth, silky leaf; good color.
3. *Austrian.* — Smooth fiber; firm; elastic.

5. Sailors demand stimulants, hence dark, strong tobaccos, containing the largest amount of nicotine poison, are selected for their use, and made into what is called navy plug.

LESSON XXI.

LITTLE THINGS.

I.

The great ocean has been formed from the small drops of rain that have fallen from the skies. The large rivers are formed by the union of smaller streams; and these smaller streams have been formed in the same way by the union of many rivulets and rills.

Trees grow so slowly that you cannot see them move in their growth; but they continue growing little by little, and after a few years you see they have increased very much in size.

The farmer who plows a field does not plow it all at one furrow, but he plows one furrow after another until the field is plowed.

When you go to school, you do not make the entire distance at one bound; but you take one step after another, and soon you have gone all the way.

All the bricks in a great building are not placed in position at a single stroke; but each workman places one brick above another, and round by round the building rises until finally it stands completed.

So it is in life. All the great things are made up of little things.

Each day we perform many duties, doing one thing at a time. If each act and each deed is good, then the entire day's action is made up of good deeds.

If you wish to become great, do not seek to become so by a single great act, but by doing well each little act that falls to your lot to do.

If you seek to be wealthy, remember the maxim, "Take care of the dimes, and the dollars will take care of themselves."

If you have a long or a difficult task before you, do not grow discouraged and say, "Oh, I can never do that!" Go at it earnestly; do one part well, and then another part, and so on, until the task is finished.

2.

It matters not how strong or how frail the object used, it is best to handle it carefully. This habit may seem to be of little importance, but it is a highly valuable and commendable one. The custom, too, of putting everything in its place when you have finished using it, is equally profitable. Performing deeds of thoughtfulness and charity may not, at the time, seem worth doing; but "little acts of kindness" make many a heart glad, converting tears into smiles and sorrows into joys.

3.

The lessons in this book relate to the common things of life; to the little duties of the home; but these common things surround us; and these little duties constitute much of the life work of a vast majority of the human family.

If any of these duties are yours to perform, their well doing will lead to the better performance of your every undertaking and to the achievement of the highest success in the ambition of your life.

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